vol. III no. 2

School Shop

FOR INDUSTRIAL ARTS & VOCATIONAL EDUCATION TEACHERS

October, 1943

Airplane Modeling—The Groundwork of Aviation Education
by E. B. Miller

Project of the Month: Toolmakers Clamp

Teaching Industrial Arts with a Purpose
by Robert E. Smith

Automechanics for the Consumer
by John L. Feirer

Shop Tested Projects ● News from Industry ● from Washington ● Strictly Personal ● News

KEEP 'EM SLUGGING

BUY WAR BONDS

Atlas 10-INCH LATHE

CONDENSED SPECIFICATIONS

Swing over Bed ..... 10¼"
Swing over Carriage ..... 6⅝"
16 Spindle Speeds ..... 28 to 2072 RPM
Thread Cutting Range ..... 4 to 96 per inch
Four Bed Lengths ..... 18" to 36" centers

Instantly reversible power cross feed and power longitudinal feed, complete V-belt drive, precision-ground bed ways.

Helps You Develop the Skills The Services Need

WALL CHARTS

Large easy-to-read charts with up-to-date technical information on a variety of subjects. Largest chart is 35½" x 25½", others 6" x 21". Complete set of five charts sent postpaid for $0.25 per set.

In the Armed services and out, the great need of the hour is still for trained men — men skilled mechanically, to make our weapons and to keep them operating on the battlefields.

Many an eighteen year old trained on Atlas Lathes will find this familiar tool in the training and mobile machine shops of our Armed forces. And many another shop student, will find Atlas tools in plants throughout the country machining millions of the vital small parts that go into our weapons.

Because Atlas is the lathe chosen so often for this work, it is also the ideal one for training. The Atlas is easy to operate—permits alert students to master fundamentals quickly for skilled work in plant or field, to learn EVERY operation performed on the modern lathe.

Write today for complete information about Atlas Lathes and the others of the 4-Tool Team. Atlas Press Company, 1036 North Pitcher St., Kalamazoo 13D, Mich.

ARMY E NAVY

Atlas

ATLAS PRESS CO.

4 Atlas TOOL TEAM FOR SMALL-PARTS MACHINING

The Cover . . . . .

These high-school boys at Samuel Gompers Trades School, San Francisco, California, will have a good basic training in radio by the time they are inducted into the armed services. Electrical communications is growing by leaps and bounds as an important element in industrial education. Postwar developments in the field of electronics indicate that school shops will be paying increasing attention to electricity and such applications as the vacuum tube.

EDITORIAL ADVISORY BOARD

M. Reed Bass, Director, Ranken School of Mechanical Trades, St. Louis, Missouri.
Earl Bedell, Director of Vocational Education, Public Schools, Detroit, Michigan.
Elmer W. Christy, Director of Industrial Arts, Public Schools, Cincinnati, Ohio.
George B. Cox, Professor of Industrial Education, Oregon State College, Corvallis.
Roy G. Fales, Supervisor of Industrial Arts, State Department of Education, Albany, New York.
George Fern, Director, State Board for Control of Vocational Education, Lansing, Michigan.
R. A. Hinderman, Director Department of Research and Vocational Education, Public Schools, Denver, Colorado.
V. P. McKinley, Professor of Trade and Industrial Education, University of Alabama, University.
George E. Myers, Professor Emeritus of Vocational Education, University of Michigan, Ann Arbor.
Louis V. Newkirk, Director of Industrial Arts, Public Schools, Chicago, Illinois.
Irvin S. Noall, Supervisor of Industrial Arts and Occupational Education, Public Schools, Salt Lake City, Utah.
Floyd W. Reeves, Professor of Administration, Chicago University.
John J. Seidel, Executive Assistant in Vocational Education, U.S. Office of Education, Washington, D.C.
Leslie G. Stier, Principal, Frank Wiggins Trade School, Los Angeles, California.
F. Theodore Struck, Head, Department of Industrial Education, Pennsylvania State College, State College, Pennsylvania.

•

Editor
Lawrence W. Prakken

Consulting Editors
Marshal L. Byrn and
Thomas Diamond

Business Manager
John M. Trytten

School Shop

FOR INDUSTRIAL ARTS & VOCATIONAL EDUCATION TEACHERS

CONTENTS

October, 1943
Vol. III, No. 2

Airplane Modeling—The Groundwork of Aviation Education. E. B. Miller.. 3
Germany got the jump on us in this important educational activity. Here is a program to shoot at, outlined by an expert from the Civil Aeronautics Administration.

Project of the Month: Toolmaker's Clamp..... 6
Here is a sample of an excellent series of projects worked up by the Vocational Division of the U. S. Office of Education and geared to VTWPW classes.

Teaching Industrial Arts with a Purpose. Robert E. Smith..... 9
The first in a series of articles on teaching industrial arts which give specific teaching technics.

News..... 15
What's doing in the field of industrial education.

Automechanics for the Consumer. John L. Feirer..... 16
Rubber conservation is just one phase of a broadened program in automechanics from the consumer angle which has been highlighted by the war.

Drawing on the Distaff Side. Frederick Halsall..... 20
How girls are being trained in drafting at the Latrobe, Penna., High School.

Strictly Personal..... 20
About your fellow teachers.

A Simple Project for Students in Electricity. R. O. Merrill..... 22
An easily constructed stand for soldering coppers that will save the bench top.

A Ten-Pin Lamp. Joseph R. Altobell..... 22
Another project utilizing the discarded maples from the local bowling alley that makes a good prize for bowling leagues.

News from Industry..... 24
New products, new equipment, industrial advancements. Send in a coupon for free information.

Instructional Resources: Books, Pamphlets, Visual Aids..... 26
Listings in easy form for clipping, pasting to cards, and filing. Keep your industrial education bibliographies up-to-date.

Latest Priority Facts.....27

A Crucible for Melting Iron. Sam Jenkin and H. I. Fieldseth..... 28
No longer do they send out of town for castings at Eveleth Manual Training School.

Adjustable Folding Drawing Table. R. L. Ready..... 30
A handy item for the drafting student to have at home.

From Washington. Michael Paca..... 32
News from the Nation's Capital of interest to shop teachers.

Index to Advertisers..... 32

School Shop is published monthly, September through June, at Ann Arbor, Michigan. Manuscripts are paid for at regular space rates and should be addressed to the Editor, School Shop, Box 100, Ann Arbor, Michigan. Subscription rates to libraries and institutions, $2.00 a year; Foreign and Canadian, $3.00 a year. 25 cents a copy. Printed in the U. S. A.

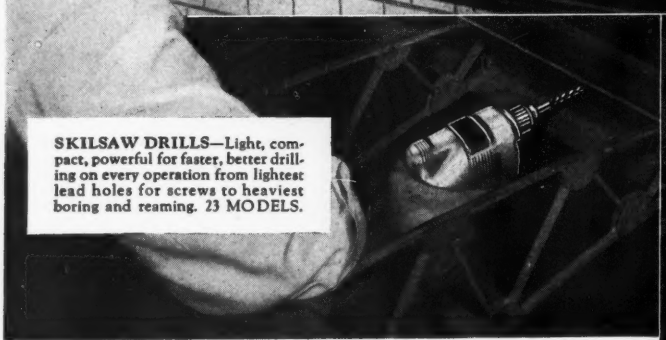
Copyright, 1943, by Lawrence W. Prakken.

Advertising Representatives: Eastern—Macintyre & Simpson, Room 1837, 101 Park Ave., New York City, Lexington 2-3783; Mid-West—Macintyre & Simpson, 75 East Wacker Drive, Chicago, Central 1715, and 1900 Euclid Avenue, Cleveland, Ohio, Cherry 1501.

PREFERRED for PRODUCTION

SKILSAW TOOLS

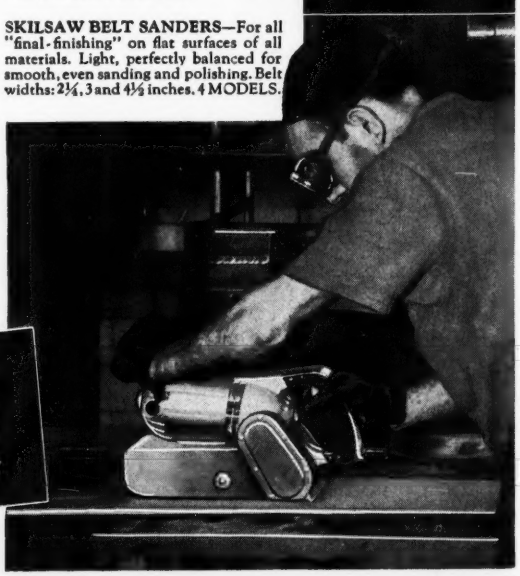
ARE IDEAL FOR INSTRUCTION!



SKILSAW DRILLS—Light, compact, powerful for faster, better drilling on every operation from lightest lead holes for screws to heaviest boring and reaming. 23 MODELS.

SKILSAW DISC SANDERS—Speed up all grinding, filing, metal cleaning, sanding, polishing and buffing on flat or curved surfaces of wood, metals and compositions. 3 MODELS.

SKILSAW BELT SANDERS—For all "final-finishing" on flat surfaces of all materials. Light, perfectly balanced for smooth, even sanding and polishing. Belt widths: 2¼, 3 and 4½ inches. 4 MODELS.



The wise way to train new workers is with industry's own tools and methods . . . *and that means* SKILSAW TOOLS! They're preferred in every field because they work faster, handle easier, get more jobs done in less time. So when your students are already adept with SKILSAW TOOLS, they'll make the shift to real production quicker in aircraft, tank and war material plants everywhere.

SKILSAW TOOLS are more powerful, but since they're lighter and more compact they make learning easier for your classes . . . *and help them do perfect work sooner!* Ask your dealer to demonstrate SKILSAW TOOLS *today!*

SEND FOR THIS FREE CATALOG! *It illustrates every tool in the SKILSAW line. Then ask your dealer to demonstrate these tools on the jobs you teach.*

SKILSAW, INC., 5029A Elston Avenue, Chicago, Ill.

New York • Boston • Buffalo • Philadelphia • Cleveland • Detroit • Indianapolis • St. Louis • Kansas City
Atlanta • New Orleans • Dallas • Los Angeles • Oakland • Portland • Seattle • Toronto, Canada

SKILSAW PORTABLE ELECTRIC TOOLS

★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

Airplane Modeling . . .

THE GROUNDWORK OF AVIATION EDUCATION

BY *E. B. Miller*

IN a recent radio address, Mr. W. A. M. Burden, Special Aviation Assistant to the Secretary of Commerce stated:

> "The boys and girls of America are eager to play their part in the greatest aviation task any country in the world has ever faced.—They want to be prepared in the most thorough possible way to do the job that confronts them."

Let us broaden upon these statements. The boys and girls are the thirty million students in the elementary and secondary schools of the country. The greatest aviation task is the building of air supremacy, that is, superior air power, commercial and military. Preparing them in the most thorough possible way is the problem confronting us.

The provisions that have made possible preflight aeronautics, and other airage education, have been progressive steps, in fact, almost impossible achievements. But much still remains to be done. We must assist in providing aeronautics training for all grades of the elementary and secondary schools. We must sharpen the relevance and enrich the content of the entire curriclum.

In view of the task that confronts us it is important that we be fully cognizant of what has been done in this field by other countries. Germany has, in the past, undertaken an intensive program in aeronautics education, and, although we may not agree with the philosophy that prompted the effort, we may profit by study of the methods, aims, problems, and achievements in that nation.

In 1933, the schools in Berlin experimented with courses in aeronautics based on the construction of model airplanes. The experiment was successful, and the Decree of November 17, 1934, broadened the plan by making aeronautics courses mandatory for all schools in the nation. In addition to providing for aeronautics training as a

Photo above: German boy model pilots on their way to the contest grounds with rubber-powered simple models constructed in the prewar German model-building program.

United States educators are just beginning what German schools have been doing for 10 years—laying a ground work for aviation training of all types. Outlining here what has been done and what can be done, the author is educational consultant to the Civil Aeronautics Administration.

part of the subject matter of the entire school curriculum, the decree provided at the outset for model airplane construction and flying at the sixth-, seventh-, and eighth-grade levels. In addition, provision was made for a four-year aviation course, and for training in the construction and flying of gliders.

The bi-weekly publication *Luftfahrt und Schule,* a magazine dealing with aviation and the school, contributed greatly to the success of the broad plan. The subject matter of this publication was comprehensive. Articles on "Air Defense and the School" dealt with problems in chemistry, mathematics, and shop work, as well as air-raid protection. Other subject matter was related to aviation and natural science, general education, geography, foreign languages, and model airplane building and flying.

No one can read this material and not be impressed with two salient points: the scope of the aviation training program, and the relative importance attached to the building and flying of airplane models which was stressed repeatedly. Illustrative of this emphasis are the following quotations from the periodical:

> "Model construction," wrote Hans Selbig, "ceases to be a game or hobby, it becomes a school subject, and must be built on a principle that raises it out of the realm of play or busy work. It must be made to involve the practical applications in the subject matter, such as arithmetic, mathematics, physics, biology and natural science."
>
> "In schools," A. Lippisch advised, "a flying model is one of the best and most practical methods of teaching the physics of flight."

There are many other articles carrying statements of a similar nature. Some of them emphasized the need to maintain the proper relationship between model airplane building and the theory of flight. Another outlined a course of study for the third to eighth grades inclusive. Still another outlined a course of study in model airplane construction for departmentally organized schools, graded according to difficulty of construction and progressively arranged for elementary schools, high schools, and colleges.

Another article stressed the importance of avoiding haphazard model building. The author, W. Haas, pointed out, "Just as in all types of instruction, teaching airplane model building requires conscientious application. Needless to say, the instructor must have built each of these models himself, so as to be able to anticipate and overcome all the difficulties which are bound to arise."

In 1937, in a report on one of the schools in Hanover, the author, Wilhelm Muhlhoff, stated: "May it be said in advance, that through the introduction of aviation, the school doesn't turn aside from the achievement of its primary aims and goals. There has been no increase in subject matter."

In converting the hobby of model airplane building and flying into aeronautics training in the schools, the Germans were confronted with the serious problem of a shortage of qualified teachers to instruct in model courses. In fact, one article pointed out that it was lamentable that in many cases only one teacher could qualify to instruct courses for which 150 to 200 boys had made application for enrolment.

What was done to provide for instructor training? There were six existing schools known as *Reichsmodelbauschulen* (schools of the Reich devoted to training in model building). These were advanced institutions and hardly suitable for giving elementary instruction in model building. Therefore, steps were taken to train teachers through the regular administration in cooperation with the National Socialist Flyers Corps (NSFK). The standard course of training consisted of 70 hours of work in the construction and flying of a series of models, starting with simple types, followed by progressively more difficult models. The 70-hour instructor training course could be taken over consecutive week-ends or in a ten-day period. So much for the German plan.

In our own country, as pointed out by Mr. Burden, we are confronted with preparing those boys and girls of America needed in aviation in the most thorough possible way. In this day of unpredictable air developments when the "doers" are disproving the "can't-be-doners" we cannot afford to overlook any opportunity to prepare our country for any contingency that may arise. For the duration of the war and in the post-war period, we are going to be drawing heavily on the youth of the nation to supply much needed aviation personnel, from laborer to aeronautical engineer, from ground crew to pilots. As Major General Carl Spaatz so aptly put it: "From the ranks of model-plane builders must come the brains, vision and skill to weld the mighty air power, upon which the salvation of this hemisphere in a large measure depends."

The U. S. Office of Education recognizes the importance of training both boys and girls in the use of hand tools, and in a recent issue of *Education for Victory* the statement was made in reference to training in aeronautics that: "Such instruction would even be more valuable if many of the principles taught in the classroom were applied in the construction and flying of airplane models."

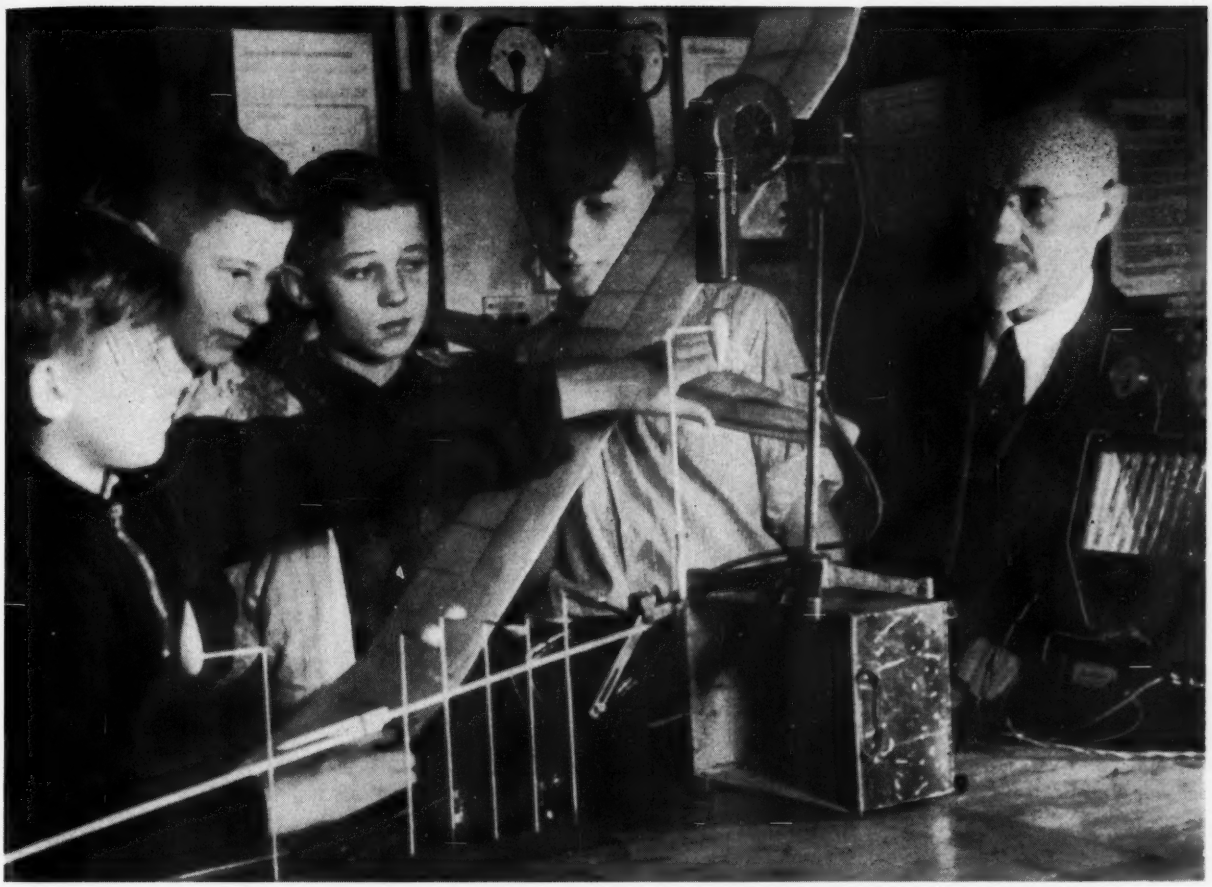
Our major consideration then is our problem of converting model building to model aeronautics, of channeling this interest into education. The fact that there are currently well over 4,000,000 boys and girls building and flying model airplanes indicates that they would welcome such a trend. There are several major channels open for making the conversion. These are:

1. Model aeronautics as a course in practical arts and industrial arts at various grade levels.
2. Model aeronautics as the homework of the practical arts and industrial arts classes.
3. Model aeronautics as extra-curricular activity.

In fusing model airplane building and flying with aeronautics training, it is well to keep in mind that in the past, aeromodeling has been a hobby and that the current material available naturally requires some conversion and attention if its apparent deficiencies are to be overcome. The major problem in using model aeronautics as a practical conveyor for education is the overcoming of these current deficiences. Here are the problems:

1. There are insufficient qualified instructors to teach model aircraft construction and flying.
2. There are insufficient graded model aircraft projects available, and current material available does not sufficiently explain the "why" of model construction and flying. In other words, a boy or girl is often told to do something in model construction or flying without having an adequate reason given.
3. The untrained instructor has difficulty supervising courses or extra-curricular work in model aeronautics because of the lack of detailed courses of study at various grade levels.
4. Detailed instructions for the use of the instructor or club leader are lacking.

In laying plans for broadening and elevating model airplane building and flying for educating the youth of the nation in aviation, we should keep in mind that model aeronautics should remain a practical application of learning by doing. We should aim for a broad series of practical projects, extending



German boys in a prewar class on model airplane construction, their first contact with the Third Reich's military aviation program. These classes are not considered as additions to the curriculum in Germany, but part of the regular educational program.

from very simple paper gliders to complicated construction work. Because the time factor is so important, we should not, and need not, hesitate to institute a program. Unqualified teachers may learn enough from the building of a few projects themselves to carry on for quite a few weeks. In the meantime, proper measures may be taken to provide ample assistance in the near future. These are the things that may be done to overcome the present deficiencies:

1. Teacher-training institutions may find it advisable to provide brief courses in model aeronautics for teachers and supervisors. In this case it would seem wisest at the outset to give prime consideration to the enrolment of teachers who, upon return to their own communities, would be in a position to undertake the training of other instructors in the field.

2. In the larger urban communities, instructors may find it advisable to establish seminar or work groups. The members of each group could undertake the construction of a predetermined graded series of models and profit by each other's successes and problems. The leader members of the Academy of Model Aeronautics could assist seminar groups considerably.

3. In some cases it may be advisable to set up intra-school planning committees to correlate courses in model aeronautics with shop work, science, and mathematics; to select graded projects for construction and outline units of study; to select study and reference material.

4. It may be of assistance to organize experimental or "pilot" courses at suitable grade levels.

5. Where it is impractical to inject model airplane building and flying into a course in the school program it will be found that students will eagerly accept aeromodeling as an extra-curricular activity.

A large percentage of the youth of the country are eager to be prepared in the most thorough possible way for the greatest aviation task facing a nation. The immediate problem then is to provide the channels of thorough training for careers in aviation.

Some Things to Remember

- *Telling* or *showing* is not always teaching. No teaching has taken place until the students have learned through self activity.
- Friendliness is one of the most important traits that a teacher can possess.
- No discipline problems will arise if all students are kept interested and busy.
- A teacher's job is to teach, not to hand out individual instruction sheets. These are to be used only as a means of *supplementing* group instruction—not *supplanting* it.
- Industrial education teachers are not *special* teachers, but are an integral part of the school faculty.
- Safety in a school shop must be *taught*, not merely talked about.
- Good "housekeeping" in a shop is one evidence of alertness and efficiency of a teacher.—*Stanley J. Pawelek*, Supervisor, Industrial Education, Baltimore, Maryland.

Project of the Month:

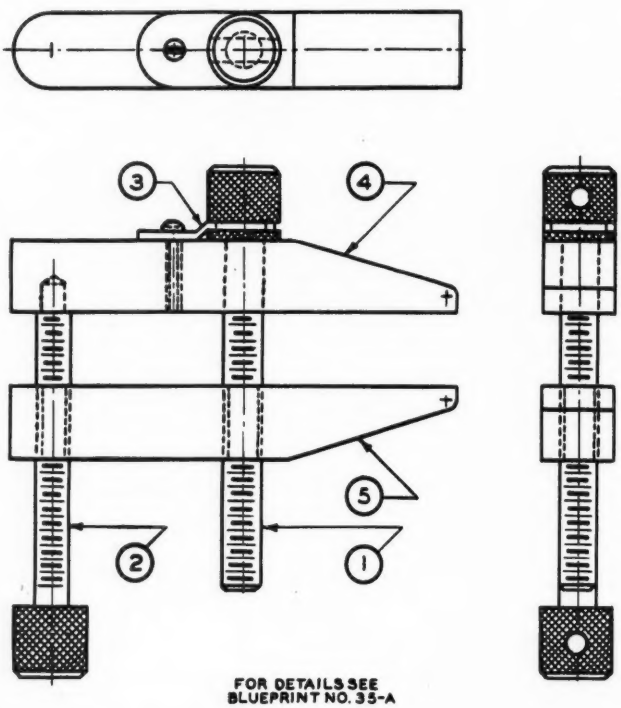
Toolmaker's Clamp...

This simple project combines an unusual number of machine-shop technics with a most useful end product. It was developed as one of a series by the U. S. Office of Education.

THE toolmaker's parallel clamp described here is a project from a series of suggested job-sheets on machine-shop training recently published by the U. S. Office of Education. The clamp is representative of the projects in the advanced series of job-sheets and combines employment of a number of machine-shop technics with a most useful end product.

The series is in three parts: part I, *Suggestions to Teachers* (Misc. 3423-1); part II, *Elementary Jobs* (Misc. 3423-2); and part III, *Advanced Jobs* (Misc. 2423-3). Each job contains complete assembly and detail tracings from which blueprints can be made, together with detailed operation sheets for each machine tool or operation involved. Copies of the series may be had by addressing the Office of Education, Vocational Training for War Production Workers, Washington, D. C.

Operation sheets for the individual jobs follow the pattern of that for the clamp, which follows:



BLUE PRINT NO. 35	PARALLEL CLAMP	DRAWN BY J. K. Compton
DRILL PRESS JOB NO. 4 LATHE JOB NO. 19 TURRET LATHE JOB NO. 8 SHAPER JOB NO. 12 BENCH JOB NO. 12	MATERIAL C.R. STEEL FINISH CYANIDE	CHECKED BY L. M. N. APPROVED BY W. P. L. DATE 2-20-43

FEDERAL SECURITY AGENCY
U.S. OFFICE OF EDUCATION
VOCATIONAL TRAINING FOR WAR PRODUCTION WORKERS
WASHINGTON, D.C.

Engine Lathe Operations

Job description: Make knurled-head screws from cold-rolled steel for parallel clamps.

Accuracy requirements: ± .010" on all fractional dimensions. No. 2 fit on threads.

Training objectives: To teach the trainee to perform the operations listed below in accordance with the time and accuracy requirements indicated for the job.

1. Turning.
2. Knurling.
3. Chamfering.
4. Thread chasing.
5. Grooving.
6. Cutting off.
7. Checking for accuracy.

Material: Bar of 5/8" CRS.

Tools, equipment, and supplies:

engine lathe
small center drill
threading tool
1/16" grooving tool
universal chuck
turning tools
micrometers
cut-off tool
knurling tool

Procedure: (Part No. 1)

1. Check engine lathe for proper running condition.
2. Install universal chuck (5/8" collet is optional).
3. Place work in chuck, extending out far enough to allow for completing piece.
4. Face and center end (use small center drill).
5. Turn to 3/8" diameter.
6. Square shoulder.
7. Set up for cutting 3/8"-24 NF threads.
8. Cut threads to fit gage.
9. Knurl head.
10. Cut 1/16" groove in head.
11. Cut off to length and chamfer head.

Procedure: (Part No. 2)

1. Follow same procedure as above except turn 1/4" diameter on threaded end; also 120° angle. Do not cut 1/16" groove as for Part No. 1.
2. Route both parts to bench for drilling and assembly (see bench operations).

Turret Lathe Operations

(alternative to engine lathe operations, for training turret-lathe operators).

Job description: Make knurled-head screws for parallel clamps. (Use turret lathe only for quantity production.)

Accuracy requirements: ± .010" on all fractional dimensions. No. 2 fit on threads.

Training objectives: To teach the trainee to perform the operations listed below in accordance with the time and accuracy requirements indicated for the job.

(Continued on page 8)

BUY MORE WAR BONDS

School Shops All Over The Land Are Playing Important Parts in Hastening VICTORY

Skilled young men and women, after "basic" training in school shops, are stepping into war plants and taking their places at the machines that are rolling out America's gigantic war production.

But there is still much more equipment . . . and lots of supplies . . . needed by many schools to bring their training plans up to the peak these critical times demand.

In order to serve such schools with typical Brodhead-Garrett service, we suggest that orders be made up at once, and sent in without delay.

1944 B-G Catalog Now Ready!

It features a surprisingly complete stock of machines, equipment and supplies you may need. Please refer to your copy in making up your order. If a copy hasn't yet been received, please write for one.

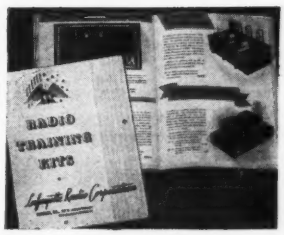
BRODHEAD-GARRETT CO.

Supplying Defense Training Needs to Schools in All 48 States

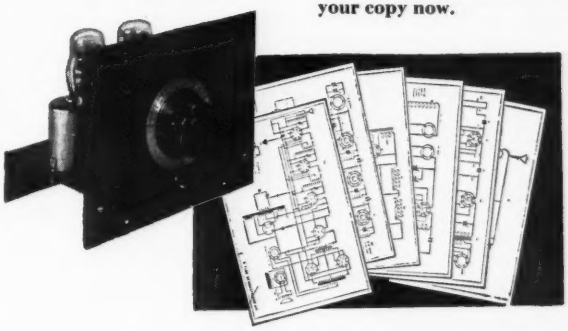
CLEVELAND, OHIO

INSTRUCTORS!

We are helping Uncle Sam and hundreds of schools, colleges and vocational training schools to teach radio and radio-physics to students and trainees—and we can help you too!



According to your requirements, Lafayette can furnish you with complete kits—kit parts if you wish to make your own kits—or we will design kits to your specifications. The Radio Training Kit brochure (illustrated) is complete and up-to-date. Write for your copy now.



Lafayette radio kits are designed for a complete progressive receiver or transmitter training program ranging from elementary to advanced radio design. Literature pertinent to all branches of training in radio and electronics is available on request. Schematic diagrams are also available, without charge, to authorized instructors.

Lafayette Radio has complete stocks of Public Address Systems, Intercommunications Systems, School Announcement Systems and Code Training Equipment. Also in stock for immediate delivery are radio and electronic parts and equipment for laboratory and U H F work, and for a complete radio-physics course.

A single order to Lafayette Radio Corp. will bring prompt delivery on all your radio requirements. Write for this EREE 130 page technical buying guide for Radio and Electronic Parts and Equipment.

Address: 901 W. Jackson Blvd. Chicago, Illinois—Dept. 10D3

LAFAYETTE RADIO CORP. CHICAGO

25 Years of Radio Reliability

LAFAYETTE RADIO CORP.

★ 901 WEST JACKSON BLVD. • CHICAGO 7, ILLINOIS

★ 265 PEACHTREE ST. • ATLANTA 3, GEORGIA

1. Set up turret lathe.
2. Turning with box tool.
3. Chamfering.
4. Threading.
5. Grooving.
6. Knurling.
7. Cutting off.

Material: Bar of 5/8" CRS.

Tools, equipment, and supplies:

box-turning tool
threading die
5/8" round spring collet
cut-off tool
5/8" feed fingers
3/8"-24 NC thread gage
chamfering tool
stock stop
1/16" grooving tool
knurling tool

Procedure:

1. Check turret lathe for proper running condition.
2. Install tools in turret.
3. Install tools in cross-slide.
4. Install collet and feed fingers in spindle of lathe.
5. Set stops.
6. Make screws.
7. Route to bench for drilling 3/16" hole and assembling (see bench operations).

Shaper Operations

Job description: Shape two pieces of 5/8" square cold-rolled steel to lay-out line.

Accuracy requirement: ± .010" on all fractional dimensions.

Training objectives: To teach the trainee to perform the operations listed below in accordance with the time and accuracy requirements indicated for the job.

1. Setting up shaper
2. Cutting to lay-out line
3. Checking for accuracy

Material: Two pieces of 5/8" square CRS, laid out, drilled, tapped (see drill-press operations).

Tools, equipment, and supplies:

small shaper
shaper tool
shaper vise

Procedure:

1. Check shaper for proper running condition.
2. Clamp both jaws in vise so that lay-out line is parallel with top of vise.
3. Set machine to proper length of stroke.
4. Shape to lay-out line (note: make final cut with fine feed for good finish.)
5. Route to bench for filing; then to heat-treat for cyanide.

Drill-Press Operations

Job description: Laying out, drilling, and tapping holes in two pieces of square cold-rolled steel.

Accuracy requirements: ± .010 on all fractional dimensions.

Training objectives: To teach the trainee to perform the operations listed below in accordance with the time and accuracy requirements indicated for the job.

1. Laying out.
2. Drilling.
3. Tapping.
4. Checking for accuracy.

Material: Two pieces of 5/8" square CRS, 3 7/8" long.

Tools, equipment, and supplies:

drill press
drill-press vise
5/16"-24 NF plug tap
No. 0 drill
No. 33 drill
drill chuck
lay-out tools
No. 1 drill
1/4" drill
6-32 plug tap

Procedure: (Parts No. 4 and 5)

1. Cut 5/8" square CRS to length in power hack saw.
2. Prepare surfaces for lay-out.
3. Lay out centers of holes and angle on pieces.
4. Drill holes according to drawing. (Note: If only one clamp is being made. hold two jaws together in vise and drill through one into other to insure alignment.)
5. Tap the holes with proper sized plug taps.

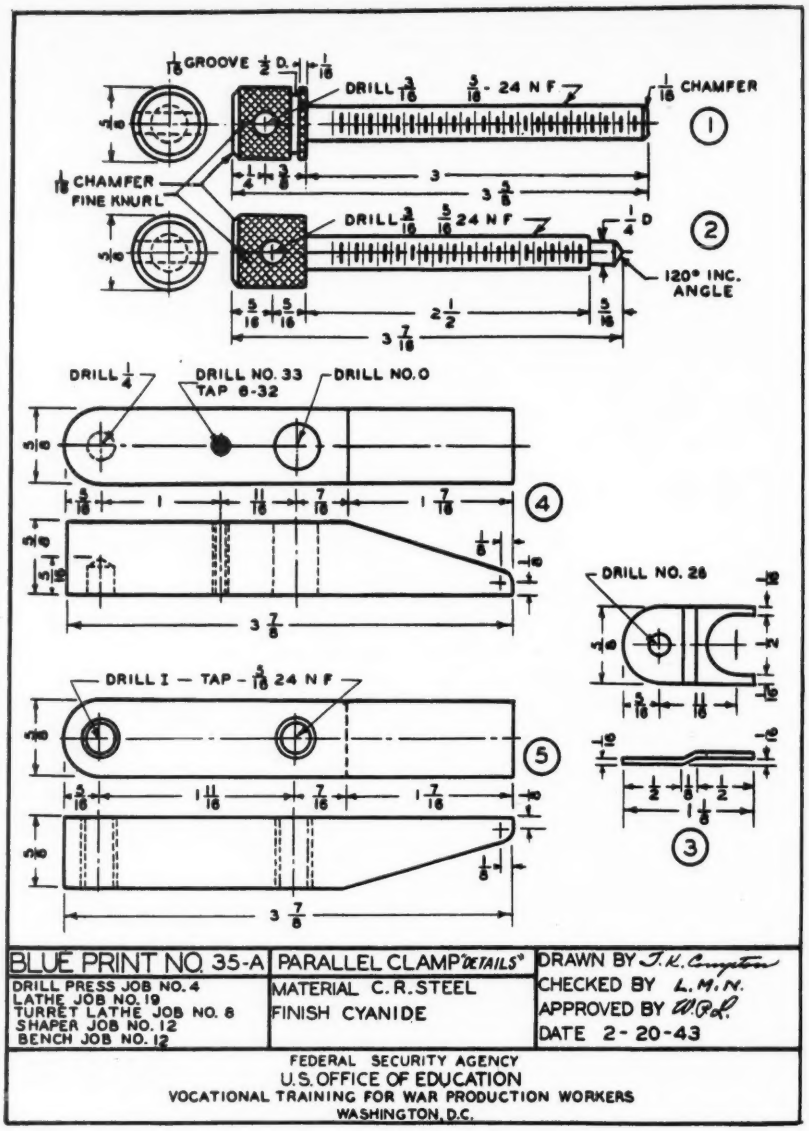
Bench Operations

Job description: Make retainer clip for parallel clamps, drill holes in screws. file jaws, and assemble parts.

Accuracy requirements: ± .010 on all fractional dimensions.

Training objectives: To teach the trainee to perform the operations listed

(Continued on page 31)



THE objectives of general education, says Robert E. Smith, Professor of Industrial Education, Ohio State University, should be determined through the cooperative efforts of all concerned with the problem—children, parents, representatives of the community, teachers, and administrators—with teachers and administrators supplying constructive leadership, but not domination.

Educational objectives determined by such a group, according to Dr. Smith, might be as follows:

▸ Development in each child of a unique personality, in which there should be concern, sensitivity, and appropriate action with respect to points of view of others, to social status, race, religion, and nationality.

▸ Development of such personal attributes with evidence of action as honesty in its broadest sense, industriousness, cooperativeness, thrift, resourcefulness, initiative, and the consideration of the rights and welfare of others.

▸ Development of ability to think through problems and to make decisions in view of all the implications involved.

▸ Concern about and sensitivity to social problems, raising the standard of living, making the world a happier and more enjoyable place in which to live.

▸ Development of an attitude of willingness to share and to participate in affairs of personal and social concern.

Not content with the mere statement of these principles, Dr. Smith has taken the next step of applying them to his specific educational field, industrial arts education. The following article, first of a series, sets forth this application of principles to industrial arts, and contains specific examples of this application.

TEACHING *Industrial Arts* WITH A PURPOSE

BY *Robert E. Smith*

GREAT is the contribution of industrial arts in achieving the educational objectives outlined above. Determination of the specific purposes of industrial arts education should be the major responsibility of the teachers in this field. The statement of purposes should then be presented to the faculty as a whole.

Advantages of this procedure are:

▸ A feeling of one-ness is generated as the collective faculty works on the problem.

▸ Since the goals established are a product of collective thinking of the group, it becomes an individual responsibility of each staff member to make his optimum contribution.

▸ A clearer and more unified concept of purposes is obtained by each participant through the give and take of the collective development.

Through such a procedure, the following statement of objectives might result:

▸ Aid students to reach a clearer, comprehensive, intelligent understanding of that important segment of social living represented by industry and business; the contributions made to social advancement, the problems of labor and capital, the responsibilities and opportunities of both worker and management, individually and collectively, to serve society.

▸ Provide students opportunities to explore and engage in a wide range of activities, so they may discover interests, aptitudes, potentialities, and needs and wants.

▸ Aid students to acquire knowledge and appreciation of the characteristics and qualities of commonly used materials such as woods, metals, plastics; their sources, methods of refining and manufacture, principal uses, care, and maintenance.

▸ Aid students to develop skills with tools and machines in forming, working, and fabricating of these materials.

▸ Aid students to develop safe, thoughtful, considerate, and socially acceptable work habits and attitudes.

▸ Aid students to acquire information, skills, and attitudes to enable them to make intelligent choices of activities undertaken.

▸ Provide students opportunities to acquire knowledge of the principles of design and abundant practice in their applications in meaningful situations.

▸ Encourage and aid students to develop such personal attributes as dependability, thoughtfulness, cooperativeness, resourcefulness, initiative, and capacity for self direction.

▸ Encourage students to develop pride in workmanship and achievement.

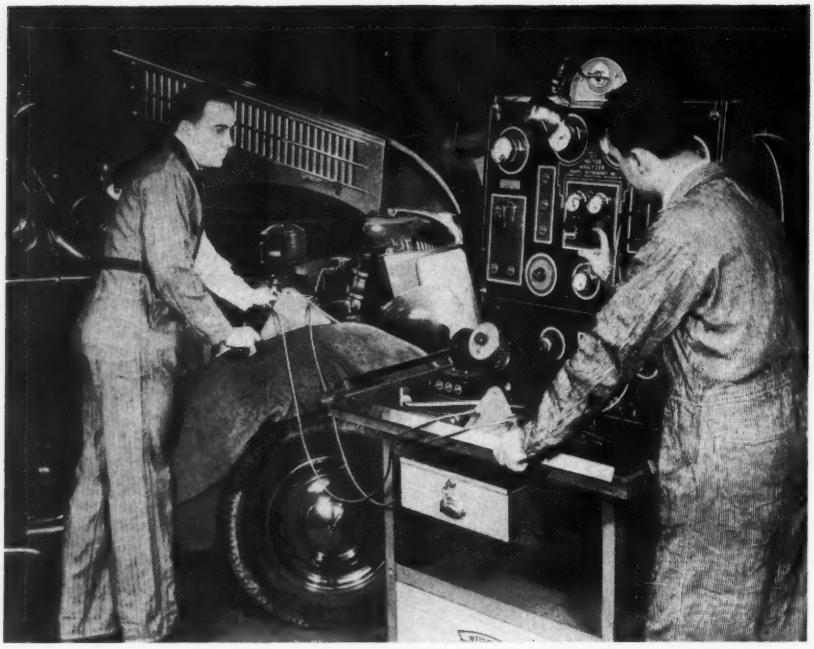
Once the purposes of industrial arts have been defined, the next step is to make a careful analysis and breakdown of the activities to be undertaken, such as work in automotive mechanics, drawing, electricity, aviation, metals, plastics, and woods.

This should be done, first, to determine skills the students will need to make progress in the laboratory and, second, to determine the knowledge and understandings they will need to become intelligent workers, consumers, and citizens. In a field as broad and diversified as industrial arts it would be impossible for a student to learn all of the operations pertaining to the area. A selection of pertinent items must therefore be made.

Before selection is made of activities and information topics, one must take into consideration such factors as maturity, past experience, the physical development of the group to be served, and the time and facilities available. These together with the purposes of the program serve as criterions when making selections. An activity or an item of information that does not satisfy some element of the criterions should not be given a place in the program.

The analytical approach to content selection and organization frequently is not employed because, first, it requires considerable thought, effort, and perseverance; and, second, analysis reveals that a tremendous amount of material, operations, and information must be covered by beginners in a first course of industrial arts. This seems to dismay many teachers. The amount of material to be covered and the number of skills to be acquired in a relatively short time may leave one with a feeling that an attempt is being made to cover too much ground in, for example, a semester. This is not a situation peculiar to industrial arts. Analysis of the activities of any subject matter area ordinarily will reflect a similar condition. For example, the child in the first four to six years of his life learns to use in conversation a much larger number of words than he does in any like period of his life.

The fact that making a comprehensive



Needs of students as potential consumers and workers are met through such courses as automotive mechanics.

analysis of a subject-matter area requires effort and is time-consuming is not a valid reason for avoiding this approach to the problem. An engineer, confronted with the problem of building a road, first makes a survey of the terrain, then takes into account the problems involved, the load to be carried, kind and quality of materials required, transportation, equipment, personnel required, etc. On the basis of his conclusions he develops a plan of procedure designed to accomplish the end desired. This method of approach enables the engineer to accomplish his goal with a minimum of effort, time, and to avoid costly errors.

In the statement of purposes above, mention is made of the development of initiative and capacity for selfdirection, and of willingness to accept and carry through responsibilities. To achieve these ends, provision must be made for students to exercise initiative and originality, to accept and carry through responsibilities. This will involve marked changes in methods from those too frequently employed. One sometimes hears the remark that what is important "is not what is taught but how it is taught." The writer takes the position that both "what" and "how" are important but that emphasis should be on method, particularly as it affects student participation and activity in all of the learning situations incident to the program.

Having established purposes and indicated a possible method of approach to the problem of effective teaching, one must employ some means of measuring the degree and quality of accomplishment. Since the procedure advocated in this paper involves many factors it follows that measurement and evaluation of outcomes will require the use of more devices than are common in measuring achievement in traditional teaching.

Certainly mastery of subject matter as a tool for solving problems is an important factor in the total educative process. Consequently, it is essential to know what progress students are making in this direction. To achieve this purpose subject-matter tests should be developed. Achievements in the laboratory or shop can be ascertained by observation—not, however the over-all superficial type so frequently employed, but rather a detailed item-by-item examination. To evaluate such intangibles as initiative, self-reliance, cooperativeness, and capacity for self direction, observation and recorded anecdotes seem to be the most productive and feasible procedures.

Evaluation in itself is of little utility when used only for establishing grades or to determine the quality and quantity of work produced. The results of evaluation may become a most useful teaching device when they are used as a means of diagnosing student weakness, difficulties, and handicaps to the end that the teacher may help the student overcome his difficulties, or to adjust the task so that the problem is within range of the student's abilities to solve.

Frequently students make the same mistake over and over again, but not with intent. Generally the mistake is repeated because the student does not know the cause of his mistakes and only too frequently the teacher has not taken the time to assist him in discovering his error. Sufficient experimental evidence in available, both in education and psychology, to show clearly that students do not intentionally make errors, that generally they do not persist in following an unapproved practice when shown their error. Students do not derive satisfaction through making errors or pursuing unapproved practices, except in cases where other motives operate, for example, to annoy an irritable teacher.

For many years the writer has used a student selfevaluating technic for evaluating laboratory or shop projects. In the application of this practice, students have been found to be almost universally honest and conscientious. This may be because emphasis is placed on discovering causes of deviations or errors to the end that bad practices may be corrected, difficulties overcome, and the quality of work improved. This procedure has been used with a number of junior and senior high-school students with comparable results. A copy of the selfevaluation forms used at Ohio State University appears below.

Data secured from test results, observations, and anecdotal records are most useful, even indispensable, when counseling students. Students who have used the selfevaluation technic tend to become quite analytical in their approach to problems, particularly those problems which affect them personally.

The following forms are merely representative of a number of teaching aids that teachers of industrial arts should prepare in advance of meeting their classes.

Selfevaluation Sheet

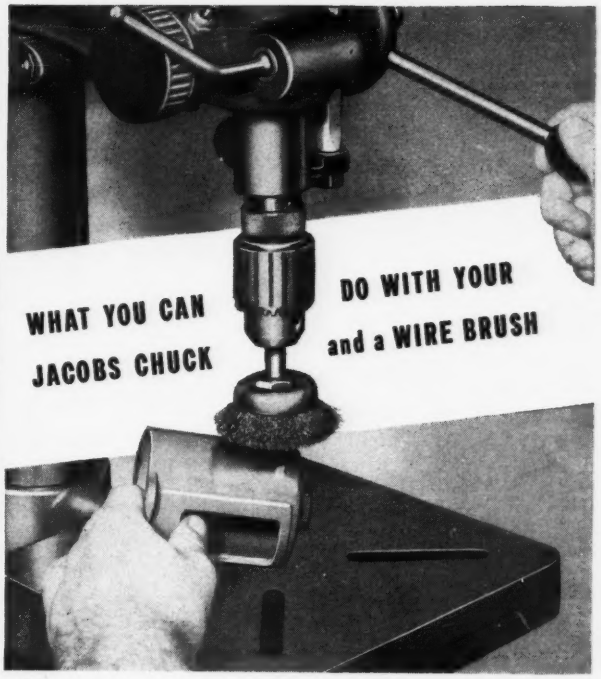
Name ----------

Date ----------

This is a form to be used in selfevaluation of projects made in the laboratory. Having completed the project, your next problem is to evaluate it in terms of the criterions given on the mimeographed material covering "Industrial Standards" in the wood- and metal-working industries.

I. Carefully read the material covering Industrial Standards, then in terms of the tolerances given compare the measurements of the finished project with those given on the original drawing or plan. In the scale of values following, place a check mark opposite

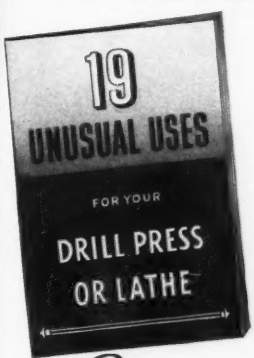
ARMSTRONG
Recognized the world over as the finest tools obtainable, ARMSTRONG TOOLS enjoy their logical position in the aviation industry. Wherever quality rules, you will find TOOL HOLDERS, WRENCHES, DOGS, CLAMPS, SETTING-UP TOOLS and MACHINE SHOP SPECIALTIES marked with the ARMSTRONG "Arm-and-Hammer."
ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
317 N. Francisco Ave. Chicago, U. S. A.



Hard surface deposits that defy ordinary removal methods quickly give way under the harsh, scratching action of the stiff wire end brush. These brushes, held by the JACOBS Chuck in a drill press or lathe, remove rust, baked-on grease, scale, and paint.

In the photo above a small casting is being burnished. Note how the wire brush gives finish to a dull casting. With a softer brush brass, copper, and other non-ferrous metals are given a soft satiny finish.

A NEW SHOP BOOKLET of DRILL PRESS and LATHE SET-UPS

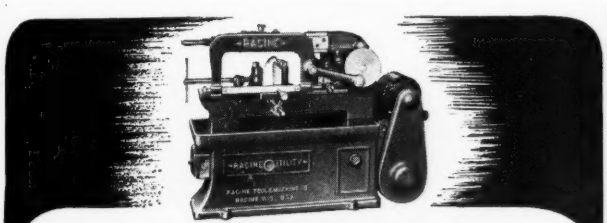


The operation outlined briefly here is one of nineteen covered in detail in one new booklet just off the press. It gives practical, helpful information on unusual and varied uses for drill presses and lathes. Printed in color and containing 49 illustrations, it shows how the set-ups are made, illustrates the tools used, and in some instances tells how to make the tools themselves. Available in any quantity to schools at 10¢ per copy.

Jacobs Chucks

WORLD'S LARGEST PRODUCERS OF DRILL CHUCKS

THE JACOBS MFG. CO.
6103 JACOBS RD., HARTFORD, 1, CONN.
Please send us ..... booklets. Enclosed is
$ ..... to cover handling and mailing costs.
Name .....
Address .....



RACINE

METAL CUTTING MACHINES

Standard for Higher Quality and Greater Precision

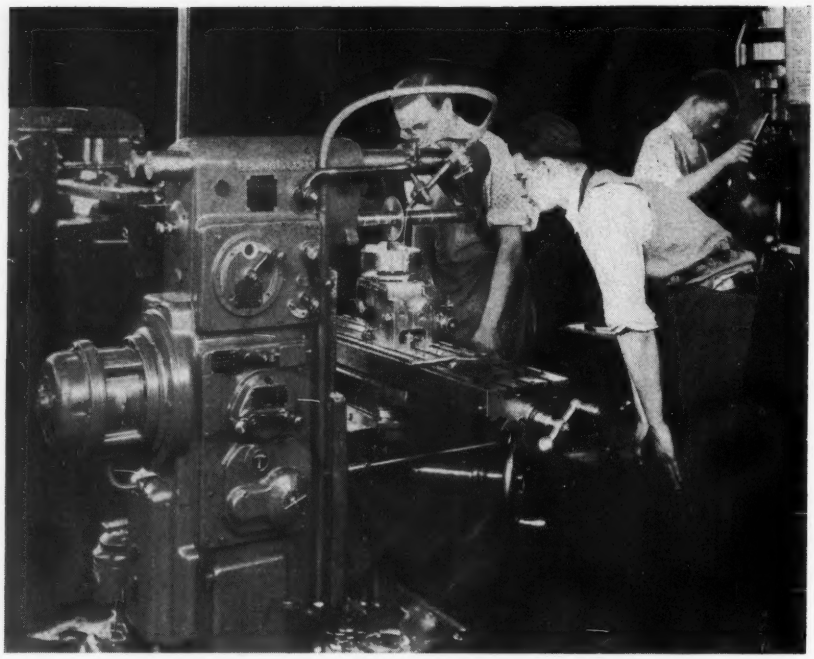
Precision built of select quality materials, RACINE SAWS are designed and built for efficient, fast, accurate metal cutting operations. • "Utility" model can be had in either Wet or Dry Cut types. Hydraulically fed and operated, these machines make training easy. Simple control devices—anyone can operate. Capacity 6"x6". • Guarded for complete safety and built for long, economical operation. • The modern saw for general purpose metal cutting. Other models up to 20"x 20" capacity are also available in RACINE'S complete metal cutting machine line.

Write today for complete literature and prices. Address Dept. 555.

STANDARD FOR QUALITY AND PRECISION

RACINE TOOL AND MACHINE CO.

RACINE, WISCONSIN • U. S. A.



Operation to extremely close tolerances is exemplified in milling-machine work, where metals must often be shaped to within .001" of dimensions.

the statement which most nearly indicates the quality of your work.

——All measurements correct within tolerances given.

——Most of the measurements correct within tolerances.

——Very few measurements correct within tolerances.

II. Carefully read the standards covering fit of joints and in terms of these evaluate your project by placing a check mark at the left of the statement below which most nearly represents the quality of your work. In case there are no joints, omit this item.

——All joints fit closely.

——Most of the joints fit closely.

——Very few joints fit closely.

III. Condition of finished surface before application of a finish coating.

——Surface free of tool tracks or scratches.

——A few light tool tracks or scratches visible.

——Many tool tracks or scratches visible.

IV. Condition of the applied finish.

——Finish evenly distributed and free from runs or overlaps.

——Finish evenly applied with only small runs or overlaps.

——Finish unevenly applied with prominent runs and overlaps.

V. Is the material you selected appropriate to the project and the purpose it is to serve?

VI. Is the type of construction you used suitable to the design and purpose for which the project is to be used, or would some other type have been better?

VII. In your judgment, is this project and design appropriate and suitable for the purpose intended?

VIII. Why did you make this project? What educational values did this problem have for you?

IX. Review the evaluation you have made, then draw a circle around the letter which most nearly represents the quality of your work, "A" being the highest and "E" the poorest.

A B C D E

Industrial Standards

Bases for Judgment In Woodworking

To be accounted a competent workman in the industrial field the worker must be able to achieve certain standards of accuracy and to make certain judgments. To achieve these goals often requires a long period of training and considerable breadth of experience. However, those who make a determined effort from the outset to become proficient achieve the goal desired much more quickly than those who approach the problem haphazardly or with a don't-care attitude. You, as a beginner, because you want to be well thought of, should put forth your best efforts to become competent as quickly as possible. As an aid in determining the progress you are making in the direction of competency, you are to be given an opportunity to rate or evaluate the quality of work you produce in the school shop.

To evaluate one's work in terms of standards, one must have a clear understanding of what these are. For your enlightenment, those for woodworking are discussed below.

Degrees of accuracy of measurements:

1. For rough carpentry, rough form building, and rough framing, a variation in measurement, plus or minus, of not more than 1/16" to 3/16" from the given dimension is considered an acceptable quality of work.

2. For ordinary carpentry work, house and roof framing, and the like, a variation in measurement, plus or minus, of not more than 1/16" to 1/8" from the given dimension is considered acceptable work.

3. For interior trim, window and door casing, baseboards, stairs and stairways, a variation, plus or minus, of not more than 1/64" to 1/32" is considered acceptable.

4. For rough woodworking, crates and rough boxes, shelves, and the like, a variation, plus or minus, of not more than 1/8" to 1/4" from the given dimension is considered acceptable.

5. For rough cabinet work, porch furniture, and rough cabinets, a variation, plus or minus, of not more than 1/32" to 1/16" from the given dimensions is considered acceptable.

6. For fine cabinet work, furniture, and cabinet making a variation, plus or minus, of not more than 1/64" to 1/32" from the given dimension is considered acceptable.

7. For pattern work, a variation, plus or minus, of not more than 1/64" from the given dimensions is considered acceptable.

Fit of joints:

1. In rough work, usually only a butt joint is used. A joint that does not show an opening greater than 1/16" between the members is considered acceptable.

2. In fine carpentry, cabinet or pattern work, a butt, miter, cross-lap, end-lap, rabbet, dado, dowel, dovetail, or mortise-and-tenon joint that shows a distinct opening between the members is not considered work of high quality.

3. *Fit of tenons.* A tenon that does not fit the mortise snugly on both sides and edges cannot be considered an acceptable job. Fitting snugly means that some force is required to push the tenon into the mortise.

Condition of the surfaces prior to application of finish: In fine carpentry, cabinet or pattern work, exposed surfaces should be free of all tool or machine marks or tracks, sandpaper scratches, or blemishes due to careless workmanship. Work that shows evidence of these cannot be considered work of high quality.

Condition of the finished surfaces:

1. If the finished surfaces show evidence that the stain, shellac, varnish, enamel, lacquer, or paint has been evenly applied, the workmanship is considered of fair quality. If there is much evidence of unevenness, the workmanship is considerd very inferior.

2. A finish that shows evidence of brush laps is considered work of inferior quality, especially if the laps are numerous or very distinct.

3. A finish that shows shellac, paint, varnish, enamel, or lacquer runs is not considered superior work. If the runs are numerous or markedly distinct, the work is considered of very inferior quality.

Exercise of Judgment

Judgment in economical use of material: Woods vary in quality, some being free of blemishes and some not; for example, knots, checks, etc. However, regardless of quality, the workman is required to be economical in its use and to use it to the best advantage. A competent workman, therefore, cuts his stock so as to avoid waste and so that blemishes will be placed where they will not be on an exposed or outer surface.

Judgment in selection of kind of material: Often the kind of material to be used in building a project is left to the judgment of the person undertaking the task. A competent workman will approach the problem somewhat as follows: (1) He will consider the purpose or purposes the finished project is to serve; on the basis of this he will determine whether a durable medium, or nondurable material should be used, what parts of the project should be made of first-class material, and in what parts material of poorer quality may be used. (2) He will determine whether

he should construct the whole project of an expensive or an inexpensive material, or if parts may be made of a less costly material. (3) He will determine what parts require a material hard in texture to avoid rapid wear. (4) He will exercise judgment in the arrangement of his material. Wood, for example, should be arranged to counteract the effects of warp, or be so arranged that warp will produce the least possible ill effects.

Judgment in kind of finish to be applied: Finishes fall in two classes: transparent and opaque. Since the choice of material often is left to the workman, he must exercise judgment in selection in terms of the finish to be applied. A competent workman usually will select an inexpensive material when an opaque finish is to be applied and an expensive one, or one with outstanding characteristics, usually grain, when a transparent finish is to be applied.

Judgment in selection of type of construction to be employed: Several factors determine or affect such judgments; for example, use, stress and strain, permanency, appearance, and cost. A competent workman takes all of these factors into consideration when making his decision. If the job demands strength, lightness, permanency, and attractiveness, then a type of construction embodying these characteristics would naturally be selected. To meet such conditions when working with wood, the selection would probably be a mortise-and-tenon, or a dovetail type of construction. On the other hand, if economy were the more important factor, then the workman would probably select a butt or lap joint construction.

Judgment with respect to appropriateness of project for purpose intended: In making such an evaluation, one should first ask: Will the project adequately and effectively serve the purpose for which it was designed? Are the proportions pleasing, and does the major outline, width, and length of the project approach one of the following proportions: 1 to 3, 3 to 4, 3 to 5, 5 to 8, or 7 to 10? Is the principal mass of the project so divided that one or more parts are dominant, outstanding? Do the outlines of appendages, handles, knobs, brackets, and the like harmonize with the main outline of the project? Do the proportions of the appendages harmonize with the proportions of the principal mass outline of the project? Is there a nice balance between major and minor parts, that is, are the smaller parts neither too conspicuous nor too inconspicuous? Do curved lines join straight lines tangentially, or at right angles? Are curved lines long and sweeping, and do they appear to flow freely and easily? Are outlines free of sharp or abrupt mechanical curves?

Industrial Standards In Metalwork

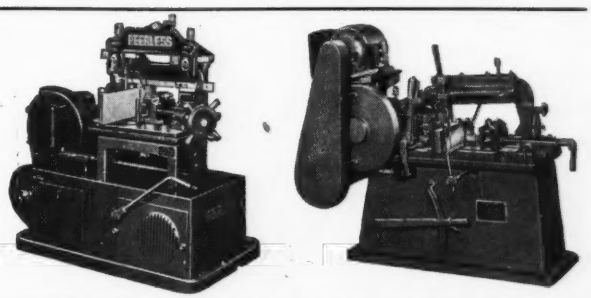
It is not easy to judge for ourselves when our work has been well done, or when it is generally acceptable for the purpose for which it is intended. Satisfactory work for one purpose may be quite unsatisfactory for another. A blacksmith and a machinist have different ideas of accuracy in their respective fields of work. Mr. Johannson, inventor of gage blocks, is concerned with 1/100,000 of an inch, the average machinist with 1/1000. But even Mr. Johannson doesn't reach perfection.

In making ball bearings for roller skates, no special attention is given to selection of the balls, but they are acceptable and used as they come from the machine which manufactures them. In spite of this, one may assume that roller skates operate quite satisfactorily. On the other hand, the American Type Founders have an engraving machine that represents the acme of exactness. It is so carefully built that it will clearly engrave the entire Lord's Prayer on the end of a piece of 4-point type, .0553″ square. A microscope must be used to read it. The interesting part is that in its construction, only one out of every 1000 of the finest balls inspected was accurate enough to be used.

Accuracy then is a relative thing. For certain purposes it would be wasteful of time and material to work in metal to 1/1000 of an inch or even 1/64 of an inch. A safe guide in judging one's own work might be the standards that industry demands. Industry, in order to make possible quantity production, has had to work out carefully stated standards of workmanship; "tolerances" industry calls them. These tolerances are usually stated as + (plus) or — (minus). For example, a piston pin may be ± .0005 variation from ¾″ diameter and still be acceptable. However, variation away from a designated size must not exceed these limits. Industry uses two gages in the testing of completed parts; in this case one would be the upper limit gage, .7505″ wide, and the other, the lower limit gage, .7495″ wide.

The work you do becomes more valuable to you when you can judge its quality for yourself. The tolerances given in the following paragraphs are those generally accepted in industry. They will be helpful to you in judging the quality of workmanship. No one should be more interested in knowing how well you are doing than yourself.

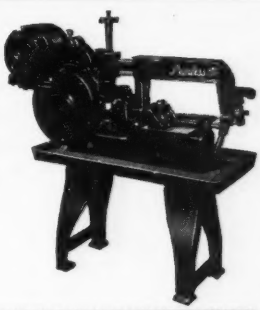
THE MORE THEY LEARN, THE MORE THEY WILL EARN



TRAIN THEM ON PEERLESS POWER METAL SAWS . . . . .

● Students gain more confidence in their ability to step right into a productive job when they are trained on the tools war industries use. Directors of vocational training know it reflects credit on the school, too, when the student is trained on machines found in everyday use in plants applying the most modern production methods.

Peerless Metal Cutting Saws are standard equipment wherever safe, accurate, fast thrifty metal cutting is required. They have unique safety features which guard the student, the metal and the saw itself. They are automatic from the beginning to the end of the cutting cycle. Address Dept. SS for literature giving other features of the Peerless Saw.



PEERLESS MACHINE COMPANY
Racine, Wisconsin

Peerless METAL SAWING MACHINES

PEERLESS MACHINE COMPANY, Racine, Wis. (Dept. SS-1043)
Please mail ( ) Catalog of Peerless Standard Power Saws
( ) Catalog of complete Peerless line: Hydraulic, Vertical and Universal Metal Sawing Machines

Name .....
School or Company .....
Address .....
City and State .....

FAST, ACCURATE CUTTING DEMANDS POSITIVE BLADE CONTROL

Forging: Forging might be classed as one of the rougher forms of metal working. Normally, work accurate within 1/16" is satisfactory. On some occasions a variation of as much as 1/8" may be allowed. If finer and more accurate work is desired, the forging process may be used to bring the metal approximately to size (never under size) and then the piece completed by more accurate methods, such as filing or grinding.

Some attention is usually given to the finish left after forging. No first-class smith would tolerate large or crude tool marks appearing on a finished piece. Frequently on fine work it is difficult to determine how the piece was shaped, the surfaces being so smooth and even. Occasionally in ornamental iron work, tool marks are purposely made conspicuous for the interesting effects obtained. This process, however, is by no means a haphazard, careless operation; quite the contrary. It takes skill, good taste, and careful workmanship to produce pleasing and interesting surfaces.

Forming Metals (Sheetmetal): Sheetmetal work demands considerable accuracy in the laying out process. A toleration not exceeding 1/64" is all that should be allowed in laying out the work on the metal. Allowances up to 1/16" are frequently allowed on the overall dimensions of the finished article. This does not mean that seams, corners, joints, etc., may vary to this extent; they should be accurate within 1/32".

First-class sheetmetal work should show no hammer or mallet marks on the finished product. Solder joints must not show more than a narrow 1/8" to 1/4" solder seam, which should be smooth and free from dirt. Seams should not appear as obviously soldered.

Casting Metal: Measurement in the casting of metals usually is not thought of as precision measurement such as found in other processes. Patterns are already prepared and dimensions cannot be altered except as unnecessary rapping of the pattern enlarges the impression. Machining usually is depended on to bring castings to size where a "fit" is important; patterns usually are oversize to allow for machine work. Thus, a tolerance of 1/32" to 1/16" can safely be allowed.

Industry does expect certain qualities in a casting. A casting should have a smooth and uniform texture; it should be free from blow holes and sand pockets. The surface should be clean and relatively smooth. Usually no depressions or surface defects are tolerated. Risers and gates should be removed without injury to the casting. Cores should be centered accurately.

Machining Metal: Industry expects greater accuracy in the machining of metals than in any other phase of metal working. Tolerations for this method of shaping metals vary over a range of .01" to .0001". Thus, it becomes necessary to indicate the type of work being performed when tolerances are discussed.

1. Filing: Work filed by hand is considered satisfactory when accurate within a toleration of $\pm$ .01".

2. Cutting: Cutting metals to length with a hacksaw, power saw, or a chisel, should be accurate with a $\pm$ 1/64".

3. Drilling: Accuracy in drilling concerns two measurements, (1) the location of the hole—variation should not be in excess of $\pm$ .01" to a possible $\pm$ 1/64", and (2) the size of the hole, toleration $\pm$ .005" to $\pm$ .01". Variations of less than $\pm$ .01 in the diameter of the hole can be achieved by reaming.

4. Turning, milling, shaping and planing: These operations are usually controlled within small tolerances of $\pm$ .005 to a $\pm$ .0005 inches. Of the four operations, shaping and planing are the less exacting and usually allow for tolerances of $\pm$ .005 and occasionally as much as $\pm$ .01 inches. Milling and turning operations should be accurate within limits of $\pm$ .005 to $\pm$ .001 and for running fits within limits of $\pm$ .0001 inches.

Machine work may be quite satisfactory for the purpose intended even at a tolerance of $\pm$ .01. This would apply in instances where general shape only is desired but certainly *not* to parts machined for "running fits" or "light drive fits".

5. Grinding: Grinding for some purposes may be of a very coarse nature. For example, when cleaning rough casting accuracy within $\pm$ .05 inches might be satisfactory. Grinding on a precision grinder has come to be one of industry's most exact processes. When tolerances less than $\pm$ .001 are to be observed, the grinding process usually is employed. Tolerances of $\pm$ .0001 are quite common and tolerances of $\pm$ .00005 inches are sometimes required.

That man has been able to develop machines that can produce work within the limits indicated above is both interesting and amazing. But let us keep in mind that man will always be greater than the machine he creates. Let your workmanship always reflect your best and finest efforts.

Now 14 Sets of TESTED PROJECT PLANS for
JUNIOR and SENIOR HIGH SHOP STUDENTS
THE COMPLETE LIST OF STANLEY PLAN SETS
Set No. 1 Hanging Shelves . . . . . 10¢
Set No. 2 Lamps . . . . . 10¢
Set No. 3 Trays . . . . . 10¢
Set No. 4 Tables and Stands . . . . . 10¢
Set No. 5 Book Ends and Small Articles . . . 10¢
Set No. 6 Flower Pot Holder and Desk Articles 10¢
Set No. 7 Mirrors, Footstool and Table . . . 10¢
Set No. 8 Magazine Stands and Tables . . . 10¢
Set No. 9 Chests and Boxes . . . . . 10¢
Set No. 10 Smokers' Stands . . . . . 10¢
Set No. 11 Workshop Equipment and Lawn Chair 10¢
Set No. 12 Sewing Stand; Book and Pipe Racks 10¢
Set No. 13 Coffee Table, End Table, Book Ends 10¢
Set No. 14 Bird Houses and Garden Furniture . 10¢
Five plans in each set . . . 70 interesting projects for your students . . . give practice in use of all standard woodworking tools. Designs generally are small in size to economize on wood needed.
Each plan is printed separately on an 8½" x 11" sheet of tough paper. Only 10¢ per set of 5 plans. Select the sets you want and order today. Send coin or stamps.
STANLEY TOOLS
DIVISION OF THE STANLEY WORKS
EDUCATIONAL DEPT. • • • NEW BRITAIN, CONN.

news

WHAT'S DOING IN THE FIELD OF INDUSTRIAL EDUCATION

INSTRUCTORS of vocational education have been listed as in the "critical" category by the War Manpower Commission in its latest pronouncement on deferrable occupations. Vocational teachers may be deferred by their draft boards but must stay at their posts.

THE War Production Board is carrying on an intensive campaign to conserve cutting tools. A limited number of posters and stickers is available from John W. Welles, Division of Information, 4th Floor, Washington Gas Light Bldg., Washington 1, D.C. School shops could help materially in this campaign.

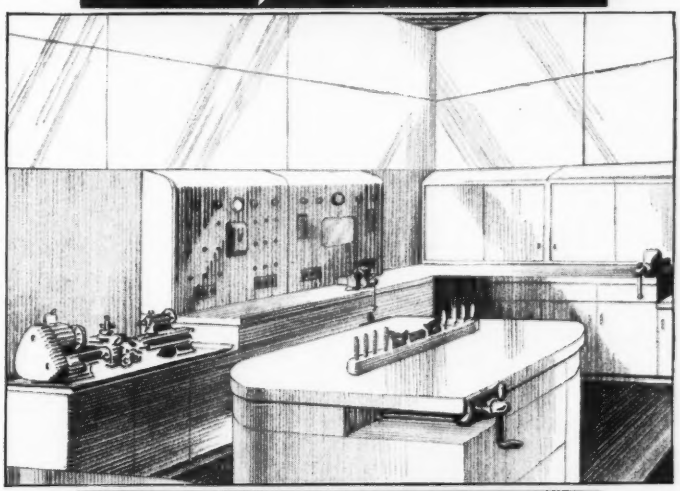
THE preinduction driver education program is receiving real cooperation from schools all over the country. In Michigan alone 90 percent of the high schools are offering driver education this semester.

To bolster declining enrolments in classes for war-production workers, regional directors of the War Manpower Commission have been instructed to urge managers of war plants to provide more training facilities for persons already on their payrolls. Vocational school teachers and equipment are being made available for this purpose. In-plant programs are also being arranged. When it has been determined that training is necessary to increase production and that there is no surplus of trained persons, the commission official will arrange for paid-training programs with the interested contractor paying the costs.

THE Higgins Ink Co., Inc., in conjunction with *Scholastic*, has announced the Fifteenth Annual Chas. M. Higgins Memorial Awards. This contest is of particular interest to drafting and drawing teachers as it provides for the awarding of 30 cash prizes and a number of gifts to junior and senior high-school students, as well as several scholarships. There are three projects in mechanical drawing, two in free-hand drawing, and one in cartooning. The projects are divided according to the extent of training of the student with prizes for first-year as well as advanced students. Considerable freedom is allowed in the selection of subjects so that drawings prepared for the regular curriculum followed by the instructor may be entered. A certificate of merit will be awarded to all winners. In the mechanical drawing section a first prize of $25, second prize of $15, and third prize of $10, and three complete waterproof drawing ink assortments for honorable mention will be given for each of the three projects. Four sets of prizes will be given in the free-hand drawing division and three in the cartooning division. Entry blanks may be secured from the Higgins Ink Co., Inc., 271 Ninth St., Brooklyn 15, N. Y.

A NEW Office of Vocational Rehabilitation has been established in the Federal Security Agency to administer the expanded federal-state civilian rehabilitation program provided under the Barden-LaFollette Act of July 6, 1943. Michael J. Shortley has been appointed director and John A. Kratz, associate director. The program will provide care for handicapped individuals not receiving service under the Veterans Administration. War disabled civilians in civilian defense activities or the merchant marine are covered by the program with the federal government assuming the entire expense of this group. State boards of vocational education will administer, supervise, and control the state programs for rehabilitation except for the adult blind.

PLAN FOR *tomorrow* WITH



Sheldon

Laboratory and Vocational Furniture

Frankly—we want to talk things over. You have the ideas and knowledge—the "know what"—of changes which tomorrow's requirements in general shop and vocational training practice will demand. We have the successful practical experience—the "know how"—in planning and building general, mechanical, auto, electrical and other shop furniture. Through working together—planning together NOW, we can prepare to meet tomorrow's shop requirements.

Take time now to write and request that our Field Engineer call—you will find these engineers keenly alert to your needs. You will find them capable in helping you visualize and reduce to practice the ideas which you are formulating.

E. H. SHELDON & CO.
728 NIMS STREET MUSKEGON, MICHIGAN

Automechanics FOR THE CONSUMER

BY *John L. Feirer*

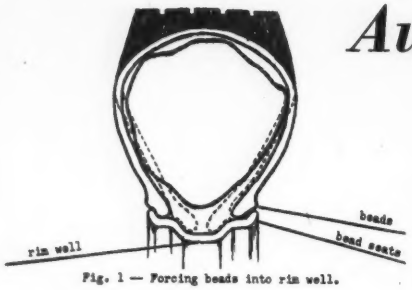


Fig. 1 — Forcing beads into rim well.

The assistance of school shop teachers in promoting tire conservation has been asked by the National Association of Independent Tire Dealers. This subject is used here as a representative unit of a complete consumer-education automechanics course. The author, now an ensign in the Training Division, U.S.N.R., taught at Western Michigan College of Education, Kalamazoo, Mich.

TWENTY-EIGHT million people are faced with a vital problem—the problem of keeping their cars in good running condition for the duration. Many individuals who have been trading their cars in for another at frequent intervals must come to realize the necessity of taking better care of the car they now have to keep. All owners whose cars are in various conditions of wear will want to secure the best possible service.

This can be realized only if the cars are given proper maintenance. Such items as proper tire pressure, sufficient oil, correct spark-plug adjustment—which previously were considered relatively unimportant details—have now become matters of vital concern. If the motorist will attend to these and many other details in car maintenance, he need have no cause for alarm, since an automobile with proper care will operate efficiently for as long as ten years or more.

The average motorist, however, does not understand what proper maintenance means. He will find it necessary to secure more information and instruction on these matters. This widespread interest should result in a demand for courses in automechanics planned primarily for the consumer.

Type of Course Needed

Many high-school and adult classes will be necessary to fill this growing need. The type of auto maintenance course will, of necessity, be quite different from that usually offered in the trade-training programs. The average motorist is not concerned with how to make major repairs, with the many technical terms in automechanics, or with a complete description of the parts of a car. He is not interested in too much theory. These courses must include only that material which every driver needs to know about the car he drives. As few technical terms and expressions as possible should be used.

To the average man operating a car, there are three major points of interest, namely: (1) information on how to avoid major repairs and replacements; (2) instruction on how to make minor repairs, such as adjustment of spark plugs and repairing of tires; and (3) related information on the use of cars in the present emergency, such as civilian and military use of highways.

Instructional Units in Automechanics

The material that is included in this course will vary somewhat with the nature of the group but, in general, there are certain basic informational and operational units that all drivers will want to know. An analysis of these units is given in Table I.

Sample of Instructional Materials

As part of the material for these classes, suitable instruction sheets are necessary. In every case these sheets should be written in the simple, everyday language that all drivers are able to understand. A sample of this type of sheet follows:

(Continued on page 18)

TABLE I

AREA	OPERATIONAL UNITS	INFORMATIONAL UNITS
General	To start a car in warm weather	Automobile taxes
	To start a car in cold weather	Gasoline taxes
	To store a car for the winter	Insurance
		Driving regulations
		Safe driving practices
		Purposes of highways
		Military and civilian use of highways
		Road signs
Chassis and Body	To check the tires	Care and use of tires
	To repair a tire	Saving tires
	To lubricate a car	Source of rubber
	To wash a car	Radiator cleaners
	To polish a car	Washing equipment
	To check the brakes	Brakes
	To check the front wheels	Liquid radiator repairs
	To check shock absorbers	Anti-freeze solutions
	To clean a radiator after winter driving	Body cleaners and polishes
	To repair a radiator with liquid compounds	Greases
	To apply frost shields	Cooling system
	To change grease in the transmission and differential	Clutch
	To put on seat covers	Need for major chassis repair or replacements
	To secure results from a heater	
Motor	To change oil	Gasolines
	To adjust a fan belt	Oils
	To change a fan belt	Fuel system
	To adjust a carburetor	Motor operation
	To replace spark plugs	Saving gasoline
	To clean carburetor filter	Saving oil
	To replace water hose	Need for major motor repair or replacements
Electrical System	To clean and adjust a generator	Spark plugs
	To clean and adjust spark plugs	Generators
	To clean and check a storage battery	Starters
	To clean and adjust the distributor points	Ignition system
	To check the lighting system	Lighting system
	To check the ignition system	Storage battery
	To charge the battery	Saving a battery
	To replace a fuse	Electrical accessories
		Need for major electrical repairs and replacements

Important Books for the School Shop

Household Mechanics — $1.34

by Bedell and Gardner — *Sixth Printing.* Meets demands of war training relating to use and conservation of important materials. *101 practical jobs.* Tests available. *134 pages.*

Exploring the Graphic Arts — $2.50

by Marinaccio and Osborn — Comprehensive orientation of Graphic Arts history, processes, occupations, materials, and industries. *Special full page work plates. 288 pages.*

Plastics—Problems and Processes — $3.00

by Mansperger and Pepper — *Second Edition, Second Printing.* Particularly useful for students planning careers in plastics after victory. *350 pages.*

Woodworking Through Visual Instruction — $1.50

by Sowers — Gives woodworking course in visual instruction form for junior high grades. Helps students become thinkers, problem solvers, planners. *25 illustrated projects.*

The Student's Planning Book — $.30

by Baysinger and Silvius — *Second Edition.* Expanded, including *illustrated tool check list describing 148 tools.* Offers progressive planning procedures for general shops. *64 pages.*

— SEND *for* EXAMINATION *Copies* —

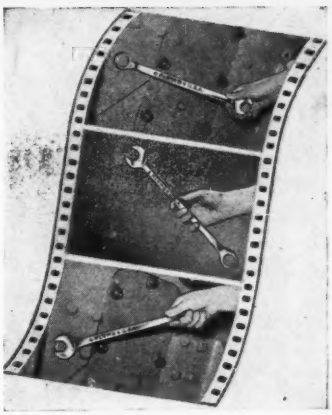
International Textbook Company—Scranton 9, Pennsylvania

PLOMB

announces a complete series of

6 TRAINING FILMS

(16mm. with sound)



"USE and CARE of HAND TOOLS"

Film No. and Title	Running Time (Min.)
101—Wrenches	20
102—Pliers & Screwdrivers	17½
103—Chisels	12
104—Hammers	11
105—Punches, Drifts & Bars	14
106—Hacksaws	18

As a contribution to the war effort this series of training films has been prepared under the supervision of the United States Army Ordnance Department. Originally intended only for use in military training centers these pictures are now being made available to schools and general industry at cost. For complete information, address —

PLOMB TOOL COMPANY

BOX 3519 TERMINAL ANNEX • LOS ANGELES 54, CALIFORNIA

THEY *all* FIT
THEY'RE *all* INTERCHANGEABLE
—INSTANTLY...and renewable

New! 32-page illustrated book "How to Build Scale Models for Defense." Expert information for your Shop Project Work.

SUPER KEEN—IDEAL FOR MANUAL TRAINING

Help the Navy! 500,000 scale model planes needed fast. X-Acto builds them better, quicker, easier. WRITE US NOW! X-Acto Crescent Products Co., Inc., 440 Fourth Ave., New York 16, N. Y.

X-acto REFILL BLADE **KNIVES**

Model Airplane Books

Tom's Book of Flying Models —Instruction Manual — 15¢ Postpaid

Flying Models—How to Build and Fly Them—Instruction Manual — 35¢ Postpaid

***Paul K. Guillow* Wakefield, Mass.**

FOR TRAINING

J. A. FAY & EGAN CO.

ESTABLISHED 1830

World's Oldest Manufacturers of Woodworking Machinery

COLERAIN, ALFRED & COOK STREETS

CINCINNATI, OHIO, U. S. A.

FOR PRODUCTION

To Repair a Tire

Introduction:

Tires are the most abused part of any motor vehicle. They are usually underinflated and, as a result, running a short distance on them causes more wear than many miles of driving on properly inflated tires. It is also true that an underinflated tire is more easily punctured. Tire inflation pressures should be checked at least once a week and tires inflated to the manufacturer's recommended pressure. This will assure better steering, safer control at all speeds, and will greatly increase the life of the tires. When a puncture does occur, the ordinary driver should be able to repair the tire. Many times the motorist may be too far distant from a repair station, or he may have two flat tires within a short distance of one another. Every driver should know the correct procedure in repairing a tire since it is a vital part of his car.

Tools and Materials:

Tire-patching equipment or vulcanizing outfit, tire wrenches, water in a container, pliers, screwdriver, and jack.

Procedure:

1. *Remove the hub cap and loosen the wheel.*—With a screwdriver pry off the hub cap. Use a tire socket wrench to loosen slightly the nuts that hold on the wheel. The nuts are loosened first as it is easier to loosen them while the wheel is still on the ground.

2. *Jack up the car.*—Set the emergency brake and put the gear-shift lever in low gear. Place the jack under the axle as close to the tire as possible. On many of the newer models, metal plates are conveniently located under each corner of the car, so that the jack can be set in place. Another type of jack fits under the bumper support. Jack up the car so that the tire is about 4″ off the ground.

3. *Remove the wheel from the hub.*—With the tire socket wrench, remove the nuts that hold the wheel in place. Place the nuts in some convenient place (the hub cap inverted), so they can be easily found.

4. *Remove the tire and tube from the wheel.*—Lay the tire flat on the ground. Use the valve cap to remove the tire valve from the tube. Be careful where the valve is placed as it is small and easily misplaced. Force the beads from the bead seats into the rim well by applying pressure with your heel to the side of the tire. Place two tire wrenches approximately 4″ on each side of the valve and lift the bead over the rim flange. See Figures 1, 2, and 3. Follow the flange with the tire tools until the outside bead is free from the rim. See Figure 4. Pull the tube out from the inside of the tire. See Figure 5. Place the two tire wrenches about 4″ apart and lift the inside bead over the tire flange. Go around the flange until the tire is free from the rim.

5. *Inspect and clean the tire.*—Examine the inside of the tire for nails, cuts, or bruises. If the tire is badly cut, it will need major repairs. Remove any nails or tacks with a pair of pliers. Powder the inside of the tire with talc.

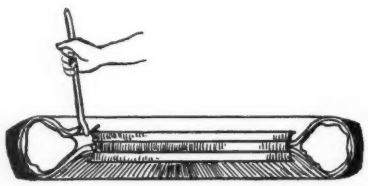


Fig. 2 — Starting the Tire Wrench.

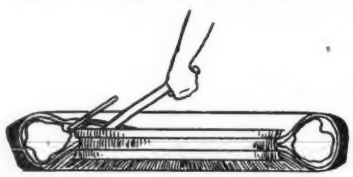


Fig. 3 — Forcing bead over rim.

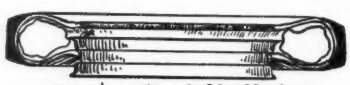


Fig. 4 — Tire half off rim.

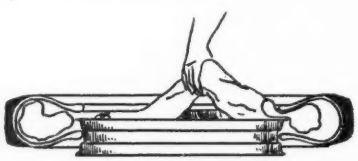


Fig. 5 — Removing tube.

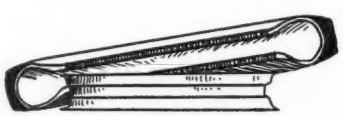


Fig. 6 — Starting tire over rim.

6. *Examine the inner tube.*—Replace the valve in the tube and inflate the tube enough so that air will be forced out through the hole when the tube is submerged in water. When the hole is located, mark the spot with a pencil. Deflate the tube and thoroughly dry the surface.

7. *Repair the inner tube.*—

A. Cold-patch method: Roughen the surface around the hole in the tube with a scraper. Apply a thin coat of tire cement and allow it to dry. Cut a patch that will cover the hole on all sides by about ¾″. Apply a second coat of tire cement around the hole and allow it to dry for about five minutes. Tear the protection sheet from the patch. Do not touch the cemented surface on the patch or around the hole in the tube. Lay the patch over the hole so that it covers uniformly on all sides. Use the round patch container and roll it back and forth over the patch to be sure that it will hold fast.

B. Vulcanizing method: Roughen the surface around the hole in the tube. Select a vulcanizing patch that will cover the hole on all sides by ½″. Remove the protection sheet from the patch and place it over the hole. Place the patch and tube in the holder and clamp the patch down tightly. Light the patch, let it burn, and then allow it to cool for five minutes. Loosen the clamp and remove the metal plate to which the patch was fastened.

8. *Inspect the inner tube.*—Repeat Step 6 to be sure that there are no other holes in the tube.

9. *Mount the tire and tube on the wheel.*—Push the inside bead of the tire into the rim well on one side. See Figure 6. With the tire wrench, work around the rim flange until the inside bead is in the rim well. Do not try to force too large a portion over the flange at one time. Inflate the tube until it is barely rounded out and insert it in the tire. Fit the valve stem into the valve hole in the rim. Start at either side of the valve with the tire wrench and force short lengths of the bead over the flange and continue around the wheel until the entire outside bead is replaced. *Turn the tire on the wheel until the valve stem lines up with the balance mark on the tire.*

10. *Inflate the tire.*—Inflate the tire to not more than *two pounds* pressure. Work the casing back and forth until the beads slip back into the bead seats. See Figure 7. The tire will be in the correct position when the molded line on the tire is equally spaced at all points around the rim. Inflate the tire to the correct pressure as indicated in the car manual. (Thirty-two pounds is the average tire pressure.)

11. *Replace the wheel on the hub.*—Slide the wheel on to the hub. Tighten the hub bolts all around gradually. If one bolt is tightened down first, the wheel will wobble because it will not fit flush on the hub.

12. *Remove the jack.*—Remove the

jack from under the car and tighten the hub bolts again to make sure that the wheel is solid on the hub. Replace the hub cap on the wheel.

Questions:

1. What are two methods of repairing an inner tube?
2. How do you locate a hole in a tube?
3. Should the tube be flat when mounting the tire and tube?
4. What factors will be improved

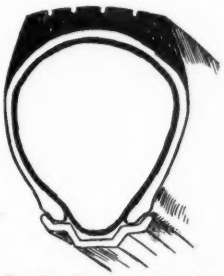


Fig. 7 — Tire and tube in place.

when the tires are properly inflated?

5. How can you tell when the tire is in the correct position to inflate it?
6. Why should the nuts on the hub be tightened gradually?

Source Material for the Course

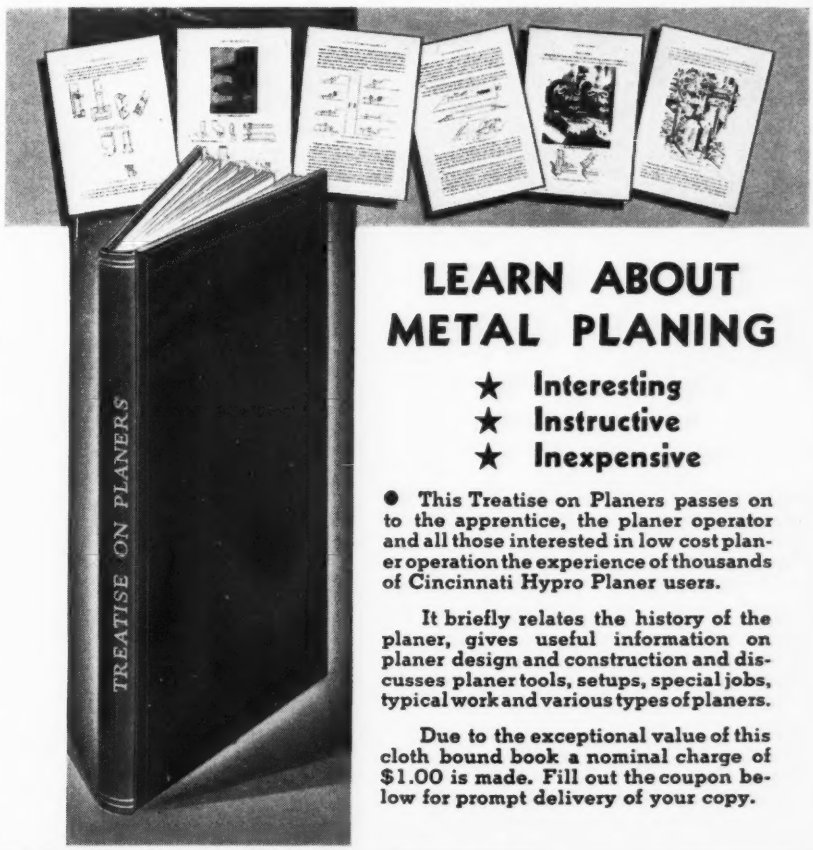
The source material for this course may come from many agencies. Most of the automobile manufacturers have recognized the need for more instructions for the average motorist and have published numerous bulletins and manuals on car maintenance. Other companies such as manufacturers of tires, tubes, batteries, etc., have published material on the best ways of caring for and using the items they produce. A number of government bulletins have been published that deal with this problem. Certain other organizations such as the A.A.A. and insurance companies have a good deal of material that would be helpful in planning such a course.

Establishing the Course

The industrial arts instructor in the high school can be of real service by establishing a course in automechanics. He will find that the major problems are those of course content, equipment, supplies, space, instructional material, and method of instruction. The equipment available in the average general shop will be sufficient. The supplies necessary are those that the average motorist needs in the care of his own car. The space limitations are not important since most of the course work can be presented in the lecture room. Instructional material can be secured from the agencies mentioned above and through utilizing the resources of the community. The instructor, without any special training in automechanics, can utilize these sources to establish proper methods of instruction.

Results of the Course in Automechanics

The results obtained will be beneficial to all individuals. Those who have not been concerned before with the proper care and use of the automobile will develop a new attitude towards its rightful place, its proper use, and its best care. These courses provide a good opportunity to introduce work on highway safety. Care of an automobile and safe driving are closely related problems. Now is the time to stress highway safety as many drivers are reducing their speed and increasing their caution in driving. Others must be made to realize this necessity because of the ever increasing number of older cars on the highways. The motorist, through these courses, will benefit himself and, at the same time, contribute his part by an increase in his efficiency and by helping to conserve vital material resources.



LEARN ABOUT METAL PLANING

★ Interesting
★ Instructive
★ Inexpensive

● This Treatise on Planers passes on to the apprentice, the planer operator and all those interested in low cost planer operation the experience of thousands of Cincinnati Hypro Planer users.

It briefly relates the history of the planer, gives useful information on planer design and construction and discusses planer tools, setups, special jobs, typical work and various types of planers.

Due to the exceptional value of this cloth bound book a nominal charge of $1.00 is made. Fill out the coupon below for prompt delivery of your copy.

THE CINCINNATI PLANER CO. 9 CINCINNATI, OHIO

THE CINCINNATI PLANER CO.
Forrer St., Cincinnati, Ohio

Attached is one dollar ($1.00) for which I am to receive a copy of your book, "Treatise on Planers".

NAME ..... TITLE .....

COMPANY .....

STREET .....

CITY ..... STATE .....

I read about your offer in School Shop.

Drawing on the Distaff Side

BY *Frederick Halsall*

Industry in and about Latrobe, Penna., needed drafting room help badly with the increasing manpower problem so Coordinator Halsall came to the rescue with womanpower in the form of high-school girls. This tells how he did it.

BASED on the results of an industrial survey and on the recommendation of industry, we decided to offer an intensive basic course in mechanical drawing, tracing, and lettering for our senior high-school girls.

At the suggestion of local industry we set up our work so that it consisted of plenty of drill in simple orthographic projections, sections, drawing technique, and intensive lettering practice. Three hundred hours' experience should establish sufficient background to enable these girls to enter industry under instruction and make rapid progress on the basis of a well-established background.

After calling the group together and explaining that this program would add approximately 15 hours to their school week, we eliminated half of them and started the class with about 30 girls, expecting a drop-out of about 50 percent the first two weeks. We had predetermined a method of elimination based on mathematics grades, attendance, and general employability. However, it wasn't necessary to do this.

In organizing a class such as this it should be kept in mind that the group is composed of immature high-school girls and that restrictions, which would not be necessary for an adult class, must be imposed. For instance, a ten-minute intermission is usually given to adult classes at the end of the first hour and a half. This was omitted in order to forestall leaving the building and straggling in a few minutes late at the end of the intermission. The girls were excused individually from class on signing a roster kept for this purpose. Because the class was held from 6:30 until 9:30 P.M., a form was used for parental consent to attend classes at this hour. The parent was notified by card if a student was dropped from class after three consecutive absences. They were also required to bring an excuse from their mother or father before we re-admitted them to class if they had missed one or two sessions. It was clearly understood that if this course was used as an alibi for not doing home work the class would be cancelled.

A college class in mechanical drawing has been conducted in our school for the past three years but it is made up of persons already employed in defense industries and may be classified as a job improvement course. We felt that our approach was from a specific and local point of view while the other was more general.

Our class has been in session for three weeks and from observation I am convinced that senior girls or very recent graduates are the most trainable, they are the easiest handled, and can adapt themselves much more easily than most adults.

Strictly Personal...
ABOUT YOUR FELLOW TEACHERS

HAROLD J. VAN WESTRIENEN, of the Michigan State Board of Control for Vocational Education, has been promoted to Chief of the Trade and Industrial Education Division, on the retirement of E. LEWIS HAYES . . . Three Nebraska industrial arts teachers now with the Armed Services are ERNEST I. GALLOWAY, Holdredge, EMIL SUDMAN, Scribner, and MAX WINTER, Benson High School, Omaha . . . FLOYD LARSON, formerly printing instructor at Menominee, Mich., and editor of the *National Printing Education Journal*, is now with the Navy at Navy Pier, Chicago . . . MARK BROOKS, supervisor of trade and industrial education and director of Vocational Training for War Production Workers for Missouri, has taken the post of Training Director for the War Manpower Commission. His area will cover the counties in Illinois and Missouri around St. Louis . . . GEORGE KOHRMAN, formerly assistant supervisor of trade and industrial education, will take Mr. Brooks' place as supervisor and Director of VTWPW . . . Miss CLEO MURTLAND, associate professor of vocational education at the University of Michigan, Ann Arbor, was honored at a dinner given by colleagues on the occasion of her retirement, effective this summer . . . JOHN J. SEIDEL is now executive assistant in vocational education in the U. S. Office of Education, Washington, D.C. He was formerly assistant superintendent for vocational education for the State of Maryland . . . The death has been announced of ROLAND V. BILLINGTON, executive assistant in vocational education, U. S. Office of Education . . . Reelected for a second term as president of the National Printing Education Association is FRED W. MILLER, supervisor of the Masonic Home School of Printing, Ft. Worth, Texas. Re-elected vice-president was HAROLD G. CRANKSHAW, Central High School, Washington, D.C. Treasurer of the association is JAMES W. LOOP, head of the printing department at Charleston, W. Va., High School . . . D. M. CRESSWELL, formerly managing editor for the American Vocational Association, is now with the Pennsylvania State Department of Public Instruction . . . The Indiana Industrial Education Association, at its twelfth annual convention in Indianapolis, elected new officers for 1943-44. They are: president, DENNIS PRICE, Indiana State Teachers College, Terre Haute; vice-president, GLEN BARKES, University School, Bloomington; secretary-treasurer, H. G. MCCOMB, War Production Training Division, Indianapolis . . . New officers of the Michigan Industrial Education Society, elected at the recent Lansing convention, are: President, LEWIS HODGES, Grand Haven; vice-president, ANDREW ALTHOUSE, Detroit; and secretary-treasurer, ARTHUR REAGH, Grand Rapids . . . EDGAR E. HOBBS is now vocational director at LaPorte, Ind., schools, replacing H. W. SCHULZE, who is now supervisor of trade and industrial education at the State Department of Education, Indianapolis . . . New officers of the American Industrial Arts Association are: President, EVERETT J. MCINTOSH, Brookline, Mass., High School; vice-president, PAUL E. HARRISON, Illinois State Teachers College, DeKalb, Ill.; secretary-treasurer, JOHN J. HATCH, State Teachers College, Newark, N.J. Committee chairman elected were: WILLIAM E. WARNER, Ohio State University, liaison and advisory board; JOHN R.

LUDINGTON, Raleigh, N.C., curriculum commission; JOHN A. WHITESELL, Oxford, Ohio, membership and affiliations; ALLEN D. BACKUS, Newark, N.J., editorial and publications board . . . J. C. BANTUM, formerly at Easton, Md., is now teaching woodwork at Greenwood High School, Princess Anne, Md. . . . ROBERT I. HELM, assistant in the industrial education department at State Teachers College, Platteville, Wis., now is instructor in industrial education at University High School, Minneapolis, Minn. . . . After three years at Kendallville, Ind., schools, E. L. SMITH has taken the position of principal and teacher of shop at Tippecanoe, Ind., public schools . . . Three Michigan shop teachers are now teaching at the Ford Airplane Apprenticeship School, Willow Run, Mich. They are DONALD STOEBLER, from Eaton Rapids; DELMAR C. YOUNG and FRANK FLORY, both of Midland . . . Lt. JOSEPH N. RIDDLE, formerly shop teacher at Hicksville, Ohio, schools, has been reported killed in action in the South Pacific.

—and now CARTOONING will win its share of SCHOLASTIC AWARDS

For fifteen consecutive years, we have been sponsoring Scholastic Awards in free-hand and mechanical drawing. Now, in this anniversary year, we announce the addition of a cartoon division in *three sections.*

Teachers . . . Students . . . send today for the pamphlet describing how students of junior high and high schools may compete for thirty cash prizes, thirty gifts, and many scholarships . . . in the three fields of free-hand drawing, mechanical drawing, and **cartooning.**

HIGGINS INK CO., INC.
271 NINTH STREET,
BROOKLYN 15, N. Y.

BOOKS to increase the efficiency of
Victory Courses

Pre-Induction

The Fundamentals of Electricity
The Fundamentals of Shopwork

By Johnson and Newkirk. Two pre-induction texts that follow with absolute conformity the Army specifications in skilled training. Each $1.32.

Aeronautics

Science of Pre-Flight Aeronautics
Elements of Pre-Flight Aeronautics

Prepared by experts; scientifically accurate; successfully at work today preparing thousands of young Americans for the air. $1.32; $.96.

THE MACMILLAN COMPANY
New York • Boston • Chicago
Dallas • Atlanta • San Francisco

BOICE-CRANE SAFETY-ENGINEERED PRECISION-BUILT SHOP-TESTED **POWER TOOLS**

MAKE ROOM FOR MORE TRAINEES • EFFECT QUICK SHOP EXPANSION • ASSURE SAFETY FOR INEXPERIENCED HANDS • AVAILABLE NOW

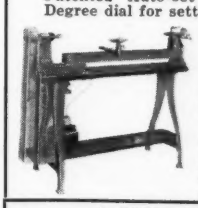
Consider the Advantages
OF THE BOICE-CRANE No. 2500
10" TILTING-ARBOR SAW

Tilting the blade instead of the table eliminates the awkward, slow, formerly hazardous method of sawing bevel cuts, and permits more accurate and smoother cutting.

Wide "working zone" in front of blade makes cross-cutting of 13" wide stock easy. 5½" table space behind blade affords plenty of outfeed support.

One-knob lightning-fast fence control with automatic rear fence locking finger, operated from front, aligns fence as it micro-sets, and eliminates the necessity of reaching over the blade. Secure and accurate alignment obtained on first lock-up.

Patented "Auto-set" screw stops tilt of blade exactly at 45° and 90°. Degree dial for setting "split-hair" angles.



Safety guard approved by State Industrial Safety Commissions.

Exclusive V-belt drive keeps motor vibration from reaching saw arbor. No motor weight on trunnions.

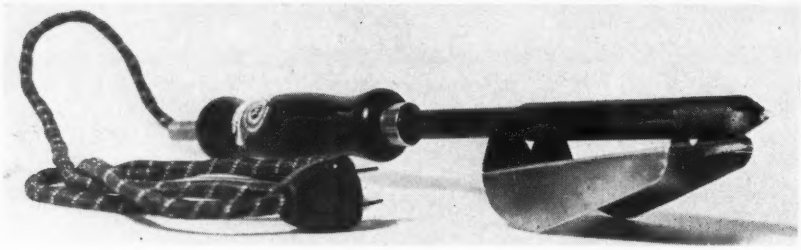
BOICE-CRANE "GAP-BED" LATHE

50% more face plate turning capacity than straight-bed type. Handles heavy work with great accuracy.

Under present priority regulations Boice-Crane machines costing less than $100.00 carry an automatic priority under CMP Regulation 5A.

FOR FREE 48-PAGE CATALOG USE THIS COUPON | **BOICE-CRANE COMPANY** 938 Central Ave., Toledo, Ohio
Name .....
Street .....
City .....

THICKNESS PLANERS • TAPPING MACHINES
SAW JOINTERS • DRILL PRESSES • BELT SANDERS
SPINDLE SANDERS • BAND SAWS • SPINDLE SHAPERS



A Simple Project for Students in Electricity

BY *R. O. Merrill,* INSTRUCTOR, ELECTRICITY AND RADIO, DEVILBIS HIGH SCHOOL, TOLEDO, OHIO

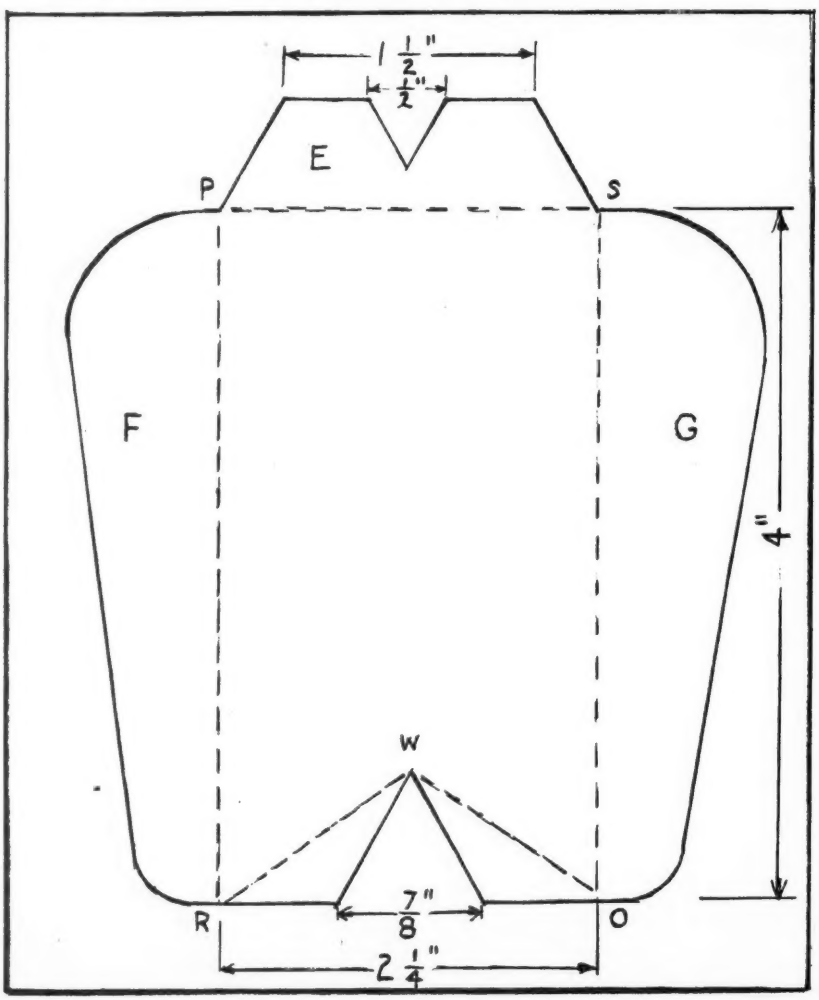
TESTED INSTRUCTIONAL PROJECT

THE writer has long felt the need in the school shop of a simple stand to prevent needless burning of the bench top.

This stand is so simple that detailed information is hardly necessary. The sketch *A* of the layout shows the dimensions needed and any scrap sheetmetal of about 22 gage is satisfactory. It has been found that this stand is quite satisfactory for any type of soldering copper.

In constructing, we have found that part *E* should first be bent up along P-S at 90°. Then *F* and *G* are bent *down* along *R-P* and *O-S* at 90°. A few touches with a file completes the job by rounding off any rough corners.

The completed job is an addition to any repairman's kit.



A Ten-Pin Lamp

BY *Joseph R. Altobell*

This lamp project has been used successfully for some time at the Ramsey County, Minn., Home School for Boys to teach simple turning and wood finishing. The table shown in the photograph on the opposite page was reclaimed by the boys from a discarded console radio cabinet. The table top was made from the radio top. The entire cabinet was refinished. The author, now stationed at Fort Knox, Ky., taught at the Ramsey County Home School for Boys.

TESTED INSTRUCTIONAL PROJECT

SUITABLE for a man's den, for the playroom, or for the summer cottage is this unique lamp made from a discarded ten-pin and a piece of 2 x 10 board. By the addition of a suitably engraved plate such a lamp may well be used as a prize or as a bowling award.

The ten-pin may be secured for little or nothing from the nearest bowling alley. Even those pins that are cracked in the neck or badly chipped can be used.

The first step consists in drilling the hole. The auger bit used is about 18" long and of 3/8" diameter. An electrician's bit with double cutters is very good for this purpose. Place the pin firmly in a vise and start the hole at the small end. Precautions must be taken to drill true so that the opening will not come out on the side. Blow out the sawdust from time to time so that the bit will not stick. Drilling the hole before the pin is turned is the best procedure, because in this way there is no marring of the finished surface. After drilling through the pin plug up the hole at the small end with a short piece of wood. After the pin has been finished in the lathe this plug may be removed by again using the long bit, entering the ten-pin from the other end.

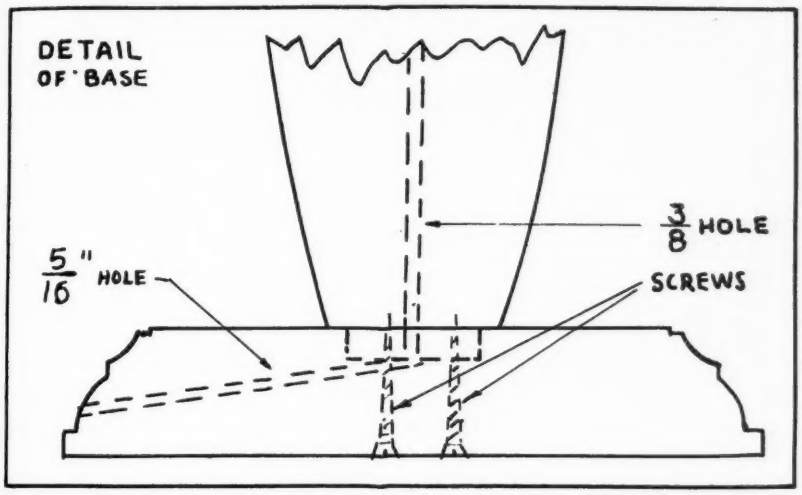
In turning the pin it is well to keep its general shape in mind. Do not lose the simple curves of the pin by using many curves and beads. Note how the lower end of the pin is shaped so as to fit into the base. Sand carefully before removing the work from the lathe.

The base of the lamp was made from a piece of scrap lumber 1½" thick. The center was cut down to provide a snug fit for the base of the pin. The top of the base may be left plain or may be made more elaborate by the addition of two or three concentric circles. The base design should be fairly simple; otherwise you will find out you have made a great dustcatcher. Bore a 5/16"

hole from the side of the base to the center.

After the electric cord has been put through the lamp base and standard, the two can be glued and screwed together. A male socket flange is used to fasten the push socket to the pin. Attach a socket harp and a suitable shade and your lamp is finished. In selecting a lampshade be sure to get one that is large enough, as a fairly large and deep shade is required for best appearance.

The lamp is then stained, and either shellacked, varnished, lacquered, or waxed according to preference. A maple finish will prove quite pleasing, or several stains may be combined to produce just the desired shades. Many craftsmen do not know that similar stains of various colors may be mixed. Of course, one cannot indiscriminately mix oil, spirit, and water stains. The lamp shown was stained a deep but ruddy tone by mixing mahogany, Adam brown, and walnut—all oil stains. Three light coats of white shellac followed, with careful rubbings between the coats. It is desirable to cover the base with felt to prevent marring the table top.



Now ready—

Suffern's

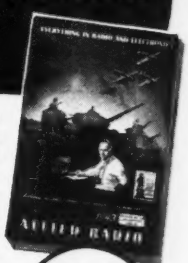
BASIC RADIO PRINCIPLES

Fills the urgent wartime need for a text on radio written from the *vocational* point of view. Gives the student basic radio fundamentals, ability to identify materials used in radio and their symbols, ability to interpret diagrams, and an understanding of the principles involved in the operation of radio equipment. Treatment is simple, with the omission of mathematics, formulas, physics, and difficult graphs. Textbook edition, $2.25.

Send for a copy on approval

McGRAW-HILL BOOK COMPANY, INC.
330 West 42nd Street New York 18, N. Y.

Everything YOU NEED in RADIO and ELECTRONICS for WAR TRAINING... for MAINTENANCE



Quick, helpful, complete service... that's what you get at Allied! Our experienced *Educational Division* which has helped hundreds of schools can offer you invaluable assistance in your radio training program. From this *one* centralized source of supply you can also procure replacement parts and maintenance needs. The up-to-date 1943 Allied Buying Guide gives you latest information on books, diagrams, kits, tubes, tools, test equipment, public address... over 10,000 items for every radio and electronic requirement. *Write our Educational Division today.*

FREE! Most Complete Up-to-Date 1943 BUYING GUIDE

USE THESE WAR TRAINING AIDS

Radio Builders Handbook.....No.37-750—10¢
Dictionary of Radio Terms....No.37-751—10¢
Radio Formulas and Data Book No.37-752—10¢
Radio Circuit Handbook.....No.37-753—10¢
Simplified Radio Servicing....No.37-755—10¢
Radio Data Handbook.....No.37-754—25¢

Write for quantity quotations

ALLIED RADIO CORP.
833 W. JACKSON, DEPT. 30-K-3, CHICAGO

ALLIED RADIO

. . . news from INDUSTRY

Lafayette Radio Corp. Expands Schools Division

Services of Lafayette Radio's Schools Division have become so popular since the beginning of the war, it has been found necessary to increase its size and scope to keep up with demands.

Facilities of the Schools Division, under the supervision of Arthur J. Rattray, above, are open to all schools and colleges. Lafayette engineers, through this division, offer advice in planning training courses and in designing electronic equipment for special applications. A brochure on radio training kits is offered, as well as schematic diagrams, radio parts catalog, etc. Lafayette Radio Corp., 901 W. Jackson Blvd., Chicago, or *check number 9 below.*

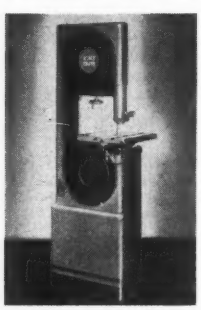
Phenol-Resin Glue Developed by Casein Co.

Cascophen LT-67 is a new phenolic-resin glue developed by Casein Company of America for use in boat, aircraft, and other wood construction where durability and waterproof gluing are required.

Cascophen LT-67 is proof against boiling or cold water, dry heat, cold, bacteria, and organic solvents. It is nonacid, noncrazing. It may be used over a wide range of setting temperature, and offers a long permissible assembly period after spreading.

A bulletin describing all features and uses of *Cascophen LT-67* is available. Casein Company of America, 350 Madison Ave., New York, or *check number 10 below.*

Boice-Crane Offers Contour-Cutoff Band Saw



An all-purpose contour and cutoff band saw is now offered by Boice-Crane Co. Bench and floor models are available.

The saw features solid, one-piece steel framework, light and strong wheels, blade-tension scale, adjustable blade guides, heavy rigidly supported table, and numerous safety features. The saw will machine metals, plastics, and wood. Literature available. Boice-Crane Co., 938 Central Ave., Toledo, Ohio, or *check number 11 below.*

Warner & Swasey Publish Turret-Lathe Paper

Blue Chips is the name of a helpful bulletin on turret-lathe operation published by Warner & Swasey Co., turret-lathe makers. The paper contains details and drawings on special turret-lathe operations, as well as valuable shop kinks of interest to machine-shop teachers and students.

Blue Chips will be sent to instructors regularly without charge. Warner & Swasey Co., Cleveland, Ohio, or *check number 12 below.*

O'Neil-Irwin Announces New Di-Acro Bender

Di-Acro Bender No. 3 has been developed by O'Neil-Irwin Mfg. Co. in response to a demand for a bender of greater capacity than smaller Di-Acro models.

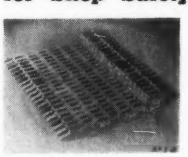
The new unit will bend a much larger radius than smaller models, and is considerably more rugged in construction. All features of previous models are included. Accuracy is guaranteed to tolerances of .001". O'Neil-Irwin Mfg. Co., 355 Eighth Ave., S., Minneapolis, Minn., or *check number 13 below.*

Hammond Introduces New Cylindrical Finisher

The new Hammond cylindrical grinding, buffing, and finishing machine is illustrated in Bulletin No. 502, which contains complete data on this centerless-type machine.

The machine will handle tubes, rods, bars, etc., from ¼" to 9" outside diameter. The machine's flexibility in arrangement for various grinding, polishing, or buffing operations is fully described. Hammond Machinery Builders, 1687 Douglas Avenue, Kalamazoo, Mich., or *check number 14 below.*

New Wood Floor Mat for Shop Safety



A flexible wood link matting has been announced by American Mat Corp. for use in shops and other places where floor safety is important. The mats, which follow the contour of the floor, are comfortable to stand on and afford good drainage. They use no rubber.

The mat is completely flexible, can be rolled or folded for handling and cleaning. The mat, 1" thick, is offered in standard sizes of 18" x 32", 24" x 38", and 30" x 44", as well as in special lengths. American Mat Corp., 1737 Adams St., Toledo, Ohio, or *check number 15 below.*

'Air Trails' Offers Teachers' Service

As an aid to teachers of aviation courses, *Air Trails*, aviation magazine, has instituted a Teachers' Service.

This service consists of six valuable instruction charts on cloud formation, and a monthly confidential letter which gives the teacher up-to-the-minute ideas for instruction, study suggestions, and class discussions. The cloud charts measure 16" x 22" and make excellent classroom displays.

Charge for this service is 50 cents. *Air Trails*, 797 Seventh Ave., New York, N. Y., or *check number 16 below.*

New All-Purpose Cleaner Made by Sugar Beet Co.

A new all-purpose cleaner operating on an entirely new principle has been developed by Sugar Beet Products Co. The new cleaner, *Formula SC-49*, is nonabrasive, and is used industrially for cleaning floors, painted surfaces, walls, and glass.

The new product incorporates recent chemical developments, using ingredients which make it fast in action and reduce physical labor in cleaning. It is claimed that *Formula SC-49* is completely safe for use and will not irritate the most tender skin. Sugar Beet Products Co., Saginaw, Mich., or *check number 17 below.*

New Catalogs . . .

15-Inch Drill Presses. 75 models of bench and floor drill presses, high or slow speed, and with from one to four spindles. Boice-Crane Co., 938 Central Ave., Toledo, Ohio, or *check number 18 below.*

Photographic Supplies. Many hard-to-get items such as exposure meters, projectors, flash guns are described in catalog number C743. Lafayette Radio Corp., 901 W. Jackson Blvd., Chicago, or *check number 19 below.*

9" Precision Lathes. South Bend 9" lathes described, illustrated, with complete data and specifications. Catalog number 9C. South Bend Lathe Works, South Bend, Ind., or *check number 20 below.*

Each item listed above is numbered. Check the numbers of the items you want, and mail the coupon, properly filled in, to . . .

School Shop,
Ann Arbor, Michigan

9 10 11 12 13 14
15 16 17 18 19 20

name .....

school .....

school address .....

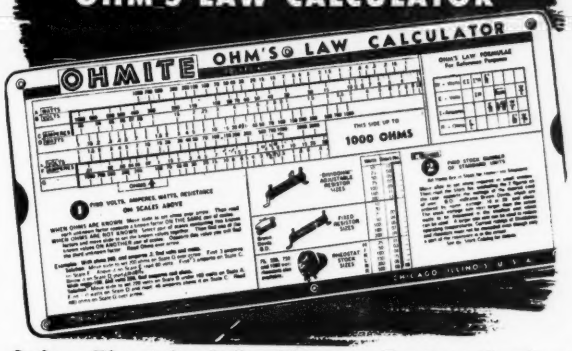
city & state .....

10-43

SEND FOR THIS HANDY

OHMITE

OHM'S LAW CALCULATOR



Solve Electrical Problems—Faster, Easier

ONLY 10¢

Thousands already in use by students and instructors. Helps figure ohms, watts, volts, amperes—quickly, easily. Solves any Ohm's Law problem with one setting of the slide. All values are direct reading. Two sides cover the range generally used in electrical and radio applications. Size 4⅛" x 9". Available for only 10c in coin to cover handling and mailing. Send for yours now!

BE RIGHT WITH OHMITE RHEOSTATS · RESISTORS · TAP SWITCHES

TEACHERS: Write for information on how you can obtain the Calculator in quantities for your student groups.

OHMITE MANUFACTURING CO.
4936 Flournoy St., Chicago, U.S.A.

Why You Should Subscribe to

THE EDUCATION DIGEST

1. The EDUCATION DIGEST brings you condensations of the most worthwhile and interesting articles from the more than 600 educational periodicals.
2. It will keep you well informed on educational matters with a minimum expenditure of time and money.
3. You will not miss such important pronouncements as the Educational Policies Commission reports, the New York Regents' Inquiry, the President's Advisory Committee Report, etc.
4. States H. P. Collins, Principal, Junior High School No. 1, Trenton, N. J.: "The money I can spend and the time I can give to the reading of educational magazines is limited and the EDUCATION DIGEST provides me with a collection of leading articles of far greater scope than I could possibly get otherwise."

SUBSCRIPTION $3 A YEAR

Send your subscription order now to

THE EDUCATION DIGEST

Box 100s

ANN ARBOR, MICHIGAN

HARGRAVE *Tested Tools*

PREFERRED BY INDUSTRY AND SCHOOLS SINCE 1879

Built to stand the hard, everyday grind of production work, Hargrave Tools have been accepted for more than 64 years as leaders in their field. Over this lengthy period, many improvements have been worked out, with the aid of skilled mechanics from some of the nation's largest plants—resulting in tools of the finest workmanship, durability and efficiency.

Write for Catalog showing our complete line of Clamps, Chisels, Punches, Bench Anvils, Saw Vises and other tools for the SCHOOL SHOP.

SEE YOUR SUPPLY HOUSE or write Dept. SC for information

The **CINCINNATI TOOL** *Co.*
Est. 1879 CINCINNATI 12, OHIO

They'll use

FRANKLIN GLUE

when they graduate to industry

GET THEM STARTED WITH IT NOW

Be practical and far-sighted. In most any woodworking plant where your students obtain employment they'll find FRANKLIN GLUE . . . a tried and true friend. You'll note the advantages in your own shop, too.

A genuine ***HIDE GLUE*** in liquid, ready-to-use form

NO MIXING
NO HEATING
NO CHILLED JOINTS

FREE SAMPLE if you make request on official school letterhead.

THE FRANKLIN GLUE CO., Columbus, Ohio

PRE-FLIGHT 16 MM
TRAINING FILMS

SILENT

AIRPLANE WELDING (2R)
AIRPLANE RIVETING (2R)
MAKING OF AN AIRPLANE FITTING (2R)
AIRPLANE SHEET METAL WORK (2R)
Rental: $3.00 per subject
Sale: $48.00 per subject

SOUND

AIR CURRENTS & THEORY OF STREAMLINING (1 R. Sd.)
Rental $1.50 **Sale: $27.00**

THE AUTOGIRO (1 Reel Sd.)
Rental $1.50 **Sale: $27.00**

CAVALCADE OF AVIATION
From the Wright Brothers to today's fighting over Europe.
2 Reels Sd. **Rental: $3.00**

AIR ARMY (1 Reel Sd.)
America's sky armada from production line to performance in the air.
Rental $1.50 **Sale: $27.00**

ARTS and CRAFTS
ART TECHNIQUE SERIES
16mm. Silent Films
MAKING A MONOTYPE.....1 reel
PLASTER CARVING .....1 reel
PLASTER CASTING .....2 reels
CARVING IN LUCITE.....1 reel

Send for Complete Information
WALTER O. GUTLOHN, Inc.
25 W. 45th St., Dept. L-10, New York 19, N.Y.

Teacher-Trainers

SCHOOL SHOP provides excellent classroom material for your teacher-training program. Write today for our special rate for group orders for prospective teachers. Address . . .

Circulation Department, SCHOOL SHOP
Box 100 ANN ARBOR, MICHIGAN

Pre-Induction Texts

★ **Principles of Electricity**
Cornetet & Fox

A new text designed specifically for pre-induction training. Follows course outline prepared jointly by War Dept. and U.S. Office of Education, to provide Senior High School boys with required basic knowledge of electricity. 258 illustrations. 240 pages. $1.60.

★ **Methods of Measurement**
Cornetet

A text-workbook that directs the student to various types and standards of measurement used in industry; to give him understanding of the best recognized theory and procedures in measuring methods. Provides definite operational exercises in making accurate, exact measurements. List price 95c (includes tests).

Write for approval copies.

McKNIGHT & McKNIGHT
Bloomington **Illinois**

instructional resources

Inquiries concerning materials described in these columns may be addressed to SCHOOL SHOP, Box 100, Ann Arbor, Mich., and will be passed on to the proper firm or person.

Principles and Practice of Radio Servicing. Hicks. New York: McGraw-Hill Book Co., 1943. Pp. xii+391. $3.50.

This book presents the fundamentals of radio servicing applied to present-day radio receivers. Chapters cover such topics as: fundamentals of magnetism and electricity, radio tubes, test equipment, theory of audio-frequency amplifiers, and frequency-modulated receivers. Each chapter contains problems illustrating applications; review questions. Illustrations; drawings. Appendix of terms, abbreviations, symbols, and charts; index.

H. J. Hicks is associate radio engineer, Aircraft Radio Laboratory, Wright Field, Dayton, Ohio, and formerly radio instructor at Hadley Technical High School, St. Louis.

Mathematics for Machinists. Burnham. New York: John Wiley & Sons, 1943. Pp. xii + 253. $1.50.

This text aims to present machine-shop calculations simply, to the machinist with a limited knowledge of mathematics. Subjects covered are: common and decimal fractions, percentage, blueprints, measurements, constructions, machine-tool applications, shop trigonometry, etc. Drawings. Problems with each chapter. Appendix; index.

Reuben W. Burnham is principal of Haaren High School, New York, N. Y.

Machine Shop Projects for Trade, Vocational and High School Shops. Knight. Bloomington: McKnight & McKnight, 1943. Pp. 112. $1.00.

Projects in this book are to meet the growing need for such material in the increasing number of school machine shops. Each project contains a working drawing in blueprint form and an operation sheet containing blanks for such information as bill of materials, machines and tools, and operations. Included also are pages on shop regulations, related topic suggestions, list of machine operations, references, and suggested additional projects.

Roy E. Knight teaches machine shop at Connersville, Ind., Senior High School.

Doall Instruction Guide. Minneapolis: Doall Trade School, 1943. Pp. 127. No charge.

This manual presents the plan of instruction developed by the Doall Trade School in training Doall operators, and now made available to shop teachers generally. Units cover each phase of Doall sawing and filing, as well as the use of attachments, power feeds, and welding of saw bands. Demonstrations and projects are included. Thumb indexed.

The Doall Trade School is maintained by Continental Machines, Inc., makers of the Doall contour-sawing and filing machine, for the training of operators.

Exploring the Graphic Arts. Marinaccio, Osborn. Scranton: International Textbook Co., 1942. Pp. xviii+274. $2.50.

This book covers the broad area of graphic expression and its development since man first began to record his thoughts. The development of all printing processes is described, as well as ink and paper making, and bookbinding. Project and exercise material accompanies each chapter. Completely illustrated with drawings and photos. Appendixes of references and plan for graphic arts laboratory. Questions; index.

Anthony Marinaccio teaches in the public schools of Hartford, Connecticut. Burl Neff Osborn is director of industrial arts education at State Teachers College, Millersville, Pa. The book is one of the Arts and Industries Series, of which Dr. William E. Warner is editor.

Alternating-Current Circuits. Morecock. New York: Harper & Brothers, 1943. Pp. xii+175. $2.75.

In the development of this book, the requirements of industry have been closely followed. Chapters cover *ac* waves and quantities, vectors and complex quantities, single-phase systems, polyphase systems—each in extensive detail. Frequent examples and problems are included. Appendixes covering report writing, graph plotting, tables. Index.

Earle M. Morecock is supervisor of the electrical department, Rochester Athenaeum and Mechanics Institute, Rochester, N. Y.

MYE Technical Manual. Indianapolis: P. R. Mallory & Co., Inc., 1942. Pp. 407. $2.00.

A manual intended to bridge the gap between theory and practice in radio. Sections of the book deal with all radio components—speakers, superheterodyne first detectors and oscillators, phono-radio service data, frequency modulation, television, capacitors, etc. The section on FM is particularly clearly written. Photos, charts, diagrams, and drawings; index.

Jordanoff's Illustrated Aviation Dictionary. Jordanoff. New York: Harper & Brothers, 1942. Pp. ix + 415. $3.50.

Each definition in this dictionary is written in clear, easily-understood language and illustrated with a drawing. Topics covered include not only the plane itself but aerobatics, aerodynamics, meteorology, navigation, radio, stress analysis, etc. A particularly interesting section of the dictionary is a glossary of American and British aviation "slanguage," also with illustrations.

Assen Jordanoff is author of *Your Wings, Through the Overcast*, and other aviation books.

Oiling the Lathe. South Bend: South Bend Lathe Works, 1942. Pp. 19. No charge.

A booklet, prepared by the technical service department of South Bend Lathe Works, describing the proper methods of oiling the various lathe parts to keep it functioning per-

fectly. The functions of lubricants and their importance are discussed, and the necessity for making regular oiling a habit. Proper lubrication of headstock, spindles, change gear, carriage, etc., is described and pictured with excellent illustrations.

Allied's Radio Data Handbook. Cooke. Chicago: Allied Radio Corp., 1943. Pp. 48. $0.25.

A compilation of the most commonly used formulas and data used in radio and electronics work. Included are fundamental mathematical data, engineering and service data, and a cross-reference index.

The book was compiled and written by the technical staff of Allied Radio Corp. and edited by Nelson M. Cooke, Lt. U. S. N., author on radio subjects.

Basic Electricity. Beauchamp, Mayfield. Chicago: Scott, Foresman & Co., 1943. Pp. viii+312. $1.60.

Chapters discuss the electric circuit; electric current; resistance; electro-motive force; magnetism; energy, power, and work; generators; motors; meters and measurements; and types of circuits. The text is intended primarily for pre-induction training, is also useful for any basic electricity course. Illustrated; index.

Shop Mathematics and Shop Theory. Amiss, Shurtleff, Moltzau. New York: Harper & Brothers, 1943. Pp. xi+360. $1.60.

In two parts, this book covers shop mathematics and machine-shop theory. The shop theory section deals with safety, manufacturing methods, gages and measuring, cutting tools, gearing, machine tools, projects, and other special subjects. Illustrations, drawings, problems. Appendix; index.

John M. Amiss is director of Industrial Education, Chrysler Corp., Detroit, Mich. G. Keith Shurtleff and Hughitt G. Moltzau are instructors in Chrysler's apprentice department.

Introductory Shopwork. Jones, Axelrod. New York: McGraw-Hill Book Co., 1943. Pp. vii+290. $2.00.

This book is patterned after the suggested outline for the U.S. Office of Education-sponsored pre-induction course in shopwork. Material covered includes hand and machine tools, measuring, tool care and sharpening, woodworking, metalwork, wiring, and rope work. Illustrated. Questions with each chapter. Index.

Mack M. Jones is professor of agricultural engineering, University of Missouri. Aaron Axelrod is instructor in machine-shop science at Bayonne, N.J., Vocational High School.

Exploring the Industries. Groneman and Williams. Austin, Texas: The Steck Co., 1943. Pp. 160. 70c.

A complete worktext to be used in the laboratory of industries or as basic material in a general shop course. Divisions on drawing and planning, woods, metals, and electricity. Contains material in detailed form on tools, processes, and problems as well as many individual projects. Intended for first-year students. Illustrated with sketches, photographs, and drawings.

The authors are members of the faculty of the Department of Industrial Education, Texas A. and M. College.

(Continued on page 28)

Latest Priority Facts . . .

THE issuance of WPB regulation CMP-5A several months ago opened the way for the purchase by school shops of much-needed items for maintenance and operation and of minor capital equipment additions. (See SCHOOL SHOP, June, 1943.)

In a revision of this regulation dated June 4, 1943, the rating assigned schools has been raised to AA-2 instead of the previous AA-2X. The most important other change affecting schools is that in determining the amount spent last year for maintenance, repair, and operating supplies, amounts spent for capital equipment should not be included. Purchases of maintenance materials this year are restricted to the same dollar volume as last year. In determining last year's dollar volume of such materials, schools should include supplies bought under any preference rating or with none at all.

In the light of this regulation, it is suggested that schools purchase under CMP-5A only maintenance, repair, and operating supplies. Items of capital equipment, then, can be bought through use of forms PD-1A or PD-408.

The WPB recommends the use of the latter form for schools, and excellent preference ratings have been reported by several schools using PD-408. Under this regulation, no restrictions are placed on amounts of equipment bought except the ability of the school to justify the use of the equipment. PD-408 assigns no blanket rating, but special ratings are given each school for each item requested in the application form. A minimum of record keeping is required under this regulation. Although this form schedules purchases on a quarterly basis, schools buying all materials at one time may continue to do so under PD-408.

Full details, as well as copies of the regulations and application forms, may be had from field offices of the War Production Board.

New Sept., '43
Low Price
Revised Edition

GENERAL SHOP HANDBOOK

Willoughby & Chamberlain

Now only 69c each
in quantities of 5 or more
Single copies only 92 cents

Expanded and revised throughout. New material to meet the demands of Pre-induction Shopwork courses—one third more information is packed into the book; yet simplified production has made possible a new wartime selling price actually lower than that of the old edition!

Includes new units on Safety, International Code, and Knot Tying, as well as many new drawings and added text material on Metalworking, Drafting, Woodwork, Plumbing and Pipe Fitting, and Tool Care. Also revisions of the units on Finishing, Concrete Work, and Electrical Work.

Just Published

JUNIOR PRINTING

By Clifford K. Lush
Supv. Ind. Arts, Mpls., Minn.

A new textbook-workbook. So attractively and cleverly presented that the instructor can depend on it not only to hold the interest and enthusiasm of the average junior-high student through such difficulties as learning the lay of the case but actually to advertise the printing course among other students. Proved through repeated tryouts in the Minneapolis school system. Large, clear, inviting photographs of methods, equipment, and procedures; many special drawings; many examples of typical commercial and school jobs.

Single copy, 68 cents.
5 or more, only 51 cents each.

Order "on approval"

The Manual Arts Press
Peoria 3, Illinois

CALLING ALL *Teachers!*

The Post Office Department will *not* forward SCHOOL SHOP if you move to a new address. The *only way* to continue to receive SCHOOL SHOP if you transfer to a new school or school system is to *let us know immediately.* Be sure to state your *school address* and the *subject you teach.* Address:

Circulation Dept., SCHOOL SHOP
postoffice box 100, Ann Arbor, Michigan

A Crucible for Melting Iron

This ingenious device made it unnecessary for the teachers at Eveleth, Minn., Manual Training School to order castings from out of town and has enabled them to carry on many projects they would not otherwise be able to attempt. Mr. Jenkin teaches machine shop and welding and Mr. Fieldseth is an instructor of pattern making and foundry.

BY *Sam Jenkin* AND *H. I. Fieldseth*

TESTED INSTRUCTIONAL PROJECT

At Eveleth whenever castings were needed for the machine-shop classes they had to be ordered from out of town, which was both inconvenient and expensive and limited the number and types of projects that we could attempt. The only metal that we could melt and pour was what could be melted in a crucible in a forge fire.

We visited neighboring schools and inspected their equipment. Some of them had furnaces for melting nonferrous metals, but what iron was melted, was melted in a cupola. Lack of space and money put that method beyond our reach.

We then visited the University of Minnesota and asked about the possibility of melting iron in a graphite crucible. Opinions differed but we received enough encouragement to go ahead.

Heat for the building was obtained from a municipal heating plant. The school plant had not been used for some time, so it was scrapped and the boiler room remodeled for use as a foundry. A section of the boiler shell 4′ long was re-formed to make a shell 40″ in diameter and the seam welded. An opening 9″ x 14″ was cut in the base and fitted with a door for draft control and ash removal. Lugs were welded on the inside about 10″ from the floor to support the grate, giving ample room for ashes. A section of double strength pipe was welded to the upper part of the shell and cemented into the chimney. The shell, up to the grate, was lined with ordinary brick, while the upper section was lined with fire brick from the old boilers, leaving a space of about an inch between the shell and the brick. This space was filled with Zonelite for insulation. The inside of the furnace was about 22″ in diameter.

For a cover we use a 24″ x 3″ circular fire brick with a hole in the center. While one crucible is being used we place a second crucible upside down over this hole for annealing. The cover is held in a fabricated frame so constructed that it can be raised with a cam arrangement and swung aside. (See photograph.)

To obtain a temperature high enough to melt iron we felt that a forced draft would be necessary, so we connected a blower from an old forge. After the first heat we dispensed with it as a natural draft gave us all the heat necessary and did less damage to the furnace lining.

We start the fire three and one-half to four and one-half hours before pouring time, depending on the amount of metal needed. A bed of 6″ to 8″ of egg-size furnace coke is well ignited before the crucible packed with iron is placed in the furnace. Coke is then packed around the crucible to a level slightly above the top of the crucible. It needs no further attention for about two hours. Then more coke is added and also more iron. It needs attention at least once every hour from this time on.

We use a No. 60 graphite crucible and usually get from 20 to 25 heats from each one. We usually pour from 140 to 150 pounds of iron, although we have poured as high as 180 pounds. The heaviest casting made weighed 169 pounds. The crucible is lifted out of the furnace with large tongs attached by cable, which runs through sheave blocks, to a small hand winch. It is then dropped into a shank, handled by two men, skimmed, and poured directly into the molds from the crucible.

The blocks, tongs, winch, furnace, and tools were all made in the school shops and very little new material was used. Outside of protective clothing, the only equipment purchased was the cable, crucibles, fire-brick cover, and the first grate.

Possibly due to beginners' luck our first pour was quite successful. What bugs crept in later were quickly eliminated. We took our troubles to Professor Holtby of the University of Minnesota and had the benefit of his counsel and advice. He also analyzed samples of our iron. The only thing off was that the silica content was slightly high.

Castings have been made for the following projects: planer vise, drill-press vise, machinist's vise, woodwork vise, floor and bench drill press, wood shaper, band saw, and jacks, besides all the miscellaneous castings needed by the high school and Smith-Hughes machine-shop classes.

More Instructional Resources

(Continued from page 27)

General Shop Handbook. Willoughby and Chamberlain. Peoria: Manual Arts Press, 1943. Pp. 96. 92c. Revised.

Originally planned for general shop courses, this handbook has been broadened to meet pre-induction needs. Covers woodwork, drawing, plumbing and pipefitting, metalwork, concrete work, electrical work, wood finishing, tool sharpening and reconditioning and related fields, rope work, and other special units. Illustrated with drawings and photographs.

George Willoughby is head of the Department of Industrial Arts, Michigan State Normal College, and Duane G. Chamberlain is Assistant Professor of Industrial Arts, Michigan State Normal College.

FILMS . . .

Tips on Slidefilms. Detroit: Jam Handy Organization, 1942. 1 reel. $0.65.

A discussional slidefilm for teachers showing how to get the most out of the instructional slidefilm in better teaching, faster comprehension, and greater student interest. The film is divided into three parts: preparing the classroom, the projector, and the use of the film itself.

Wanted!

SCHOOL SHOP is looking for good manuscripts that will be of practical help to teachers of shop subjects. Material is needed in the new fields which preinduction training has emphasized as well as in the customary subjects. Fields in which material is particularly sought are

Radio	*Woodworking*
Electricity	*Sheetmetal*
Machine Shop	*Aviation*

Please emphasize the instructional values of project material. Send in clear glossy photographs and good working drawings in ink on white paper. Articles are paid for at regular space rates. Send them to

SCHOOL SHOP MAGAZINE
BOX 100 ANN ARBOR, MICH.

Here's the RADIO MANUAL *YOU MUST HAVE!*

THE IDEAL RADIO MANUAL FOR INSTRUCTORS

THE new Meissner "How to Build" Radio Instruction Manual, edited by expert Radio Engineers is fully illustrated with charts, Radio Formulae, Schematic Circuit Diagrams and Pictorial Wiring Diagrams. Contains a complete outline of Frequency Modulation Theory. Construction data on 22 kits for building radio receivers and adapter units, with operating instructions and servicing data on over a dozen complete assemblies, including FM Receivers, Phonograph-Recorder, and radio equipment, also gives you valuable coil design and circuit application data.

the NEW
Meissner
"How to Build"
INSTRUCTION MANUAL
FULLY ILLUSTRATED WITH CHARTS RADIO FORMULAE SCHEMATIC CIRCUIT DIAGRAMS AND PICTORIAL WIRING DIAGRAMS
Price Fifty Cents
Ideal for Beginners, Advanced Students and Instructors

The Radio Instruction Manual for the beginner and the advance student training.

Price, only 50 cents post paid anywhere in the U.S.A. (seventy-five cents in Canada). Send for your copy today!

Meissner
MT. CARMEL, ILLINOIS
"PRECISION-BUILT PRODUCTS"

A Finer Place to Stay

FORT MEIGS HOTEL

The superiority of Fort Meigs Hotel is attested to by experienced travelers who appreciate its beautiful, comfortable accommodations and reasonable rates. Purple Cow Coffee Shop and Maritime Buffet serve the best food in Ohio.

EDWARD SHERMAN, Manager
St. Clair between Madison & Jefferson

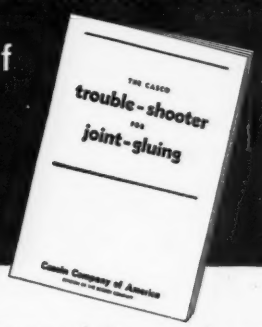
TOLEDO

ONE OF THE ALBERT PICK HOTELS

400 ROOMS WITH BATH
from **$2.50**

FREE! "FIRST-AID" GLUING HANDBOOK

For Instructors of Advanced Woodworking Classes



● Written for inspectors and glue-room foremen in industry, the "Casco Trouble Shooter" for joint gluing is helpful as a practical text and reference book for vocational instructors—especially those teaching aircraft woodworking.

Subjects include: How to identify the cause of a poor glue joint; The mechanics of casein and resin glue; Common gluing faults and their remedies; Mixing, spreading, pressing and maturing procedures, etc. 22 pages. Easy to read.

Your copy gladly sent if you request on school letterhead.

CASEIN COMPANY OF AMERICA
DIVISION OF THE BORDEN COMPANY
350 MADISON AVENUE, DEPT. SS 10, NEW YORK 17, N. Y.

Adjustable Folding Drawing Table

TESTED INSTRUCTIONAL PROJECT

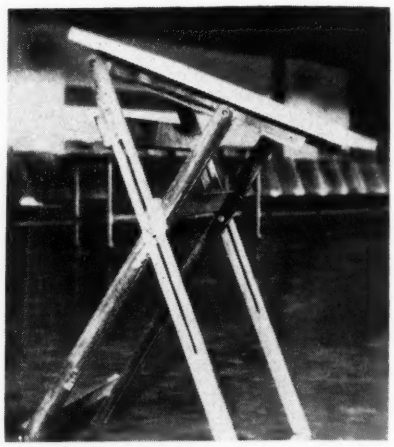
AFTER a great deal of experimenting to find a practical drawing table for home use and one that could be made by a beginning shop student, I finally settled on the accompanying drawings. I found this the most practical for several reasons. It is simple of construction, inexpensive, adjustable, and folds up so that it can be easily stood away when not in use; with the top in the horizontal position it makes an excellent typing or study table.

The dimensions shown on the drawings are for a 24″ x 30″ top. If a smaller or larger top is used, some of the dimensions will need to be changed. The top may either be made in the shop, or in case the shop has no facilities for gluing and finishing so large a piece, an ordinary drawing board may be used.

Construction details are clearly shown in the drawings.

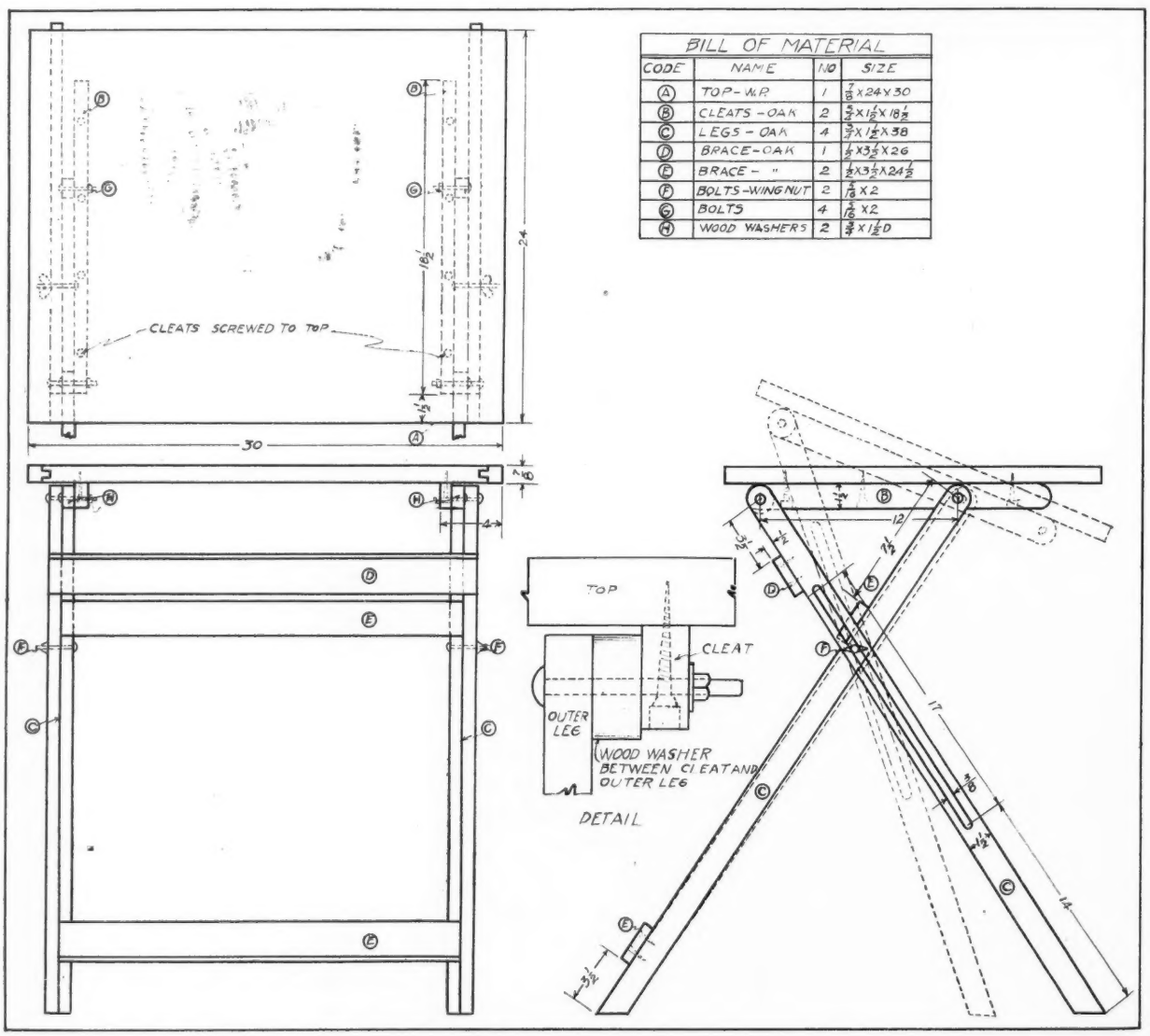
BY *R. L. Ready*

Here is a project that not only is suitable for the beginning woodworking student but also has the advantage of usefulness at home. Many skills can be taught in its construction. The author teaches industrial arts at the Batavia, Illinois, High School.



BILL OF MATERIAL

CODE	NAME	NO	SIZE
A	TOP - M.R.	1	7/8 X 24 X 30
B	CLEATS - OAK	2	3/4 X 1 1/2 X 18 1/2
C	LEGS - OAK	4	3/4 X 1 1/2 X 38
D	BRACE - OAK	1	1/2 X 3 1/2 X 26
E	BRACE - "	2	1/2 X 3 1/2 X 24 1/2
F	BOLTS - WING NUT	2	5/16 X 2
G	BOLTS	4	5/16 X 2
H	WOOD WASHERS	2	3/4 X 1 1/2 D



Toolmaker's Clamp . . .

(Continued from page 8)

below in accordance with the time and accuracy requirements indicated for the job.

1. Laying out.
2. Filing.
3. Bending.
4. Drilling.
5. Hand grinding.
6. Checking for accuracy.
7. Assembling.

Material: 1/16" x 5/8" flat strip stock. All parts for assembly.

Tools, equipment, and supplies:

drill press — bench vise
8" flat mill file — No. 26 drill
3/16" drill — screw driver
pedestal grinder — abrasive cloth

Procedure:

Parts No. 1 and 2: (routed from lathe)

1. Drill 3/16" hole on drill press. (Note: use small universal drill jig if a large number of pieces are to be drilled.)
2. Countersink both sides lightly to remove burrs. Hold for assembly.

Part No. 3:

1. Cut stock to twice length called for in drawing.
2. Lay out to drill ½" hole in center of piece and No. 26 hole in each end.
3. Drill holes.
4. Cut piece in two through ½" hole.
5. Round end (grind and file). Caution: use goggles or other eye protection while grinding.
6. File to remove all burrs.
7. Bend required offset in piece. Use bench vise. Hold for assembly.

Parts No. 4 and 5: (routed from shaper)

1. Remove all burrs with 8" flat file.
2. Grind and file radii on both ends as in drawing. Caution: use goggles or other eye protection while grinding.
3. Finish smooth with abrasive cloth.
4. Route to heat-treat for cyaniding and then back to bench for assembly.

Assembly:

1. Bring all parts together and assemble complete clamp.

from Washington . . .

(Continued from page 32)

Schools will have to bear the cost of packing and shipping—which in the case of a plane may run up to several hundred dollars.

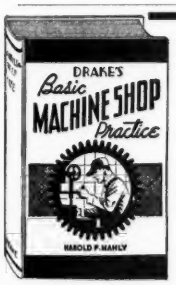
Washington officials caution: "Schools should not write to Washington for salvage material. Apply to your State Board of Education."

● As your reporter made the rounds of Washington offices, he heard:

In the War Department: "Well, Italy has capitulated. There's a basic reason for her sad showing in modern war. Her people simply cannot handle tools and machinery."

At the Manpower Commission: "A plan is now being worked out to give honorable discharges to vocational education teachers and other instructors now in the Army, if their boards of education request such action. I say, they should have never been inducted in the first place."

At the Executive Offices of the President: "The Osborn report is on the President's desk. (Note: Brig. Gen. Frederick H. Osborn heads a committee appointed by the President last year to draw up plans for continuing the education of soldiers and sailors, especially those who interrupted their schooling in the last year of high school and first years of college.) "I can tell you, if you don't mention my name, that the report suggests a program made up of 20 percent general education and 80 percent vocational training. Looks like another big job for trade schools."



SHOP INSTRUCTORS

teach a higher paying trade with

DRAKE'S BASIC MACHINE SHOP PRACTICE

COMPLETE—EASILY TAUGHT

Now, you can teach machine shop technique . . . easily. This amazing new book, just off the press, gives full information . . . authentic, practical and easy to understand. Complete details on layouts, use of machinists tools, as well as standard operations performed on lathe, drill press, shaper, planer, milling machine and grinding machines, both external and internal. Deals with specific jobs and gives step-by-step rules for performing principal operations. All material carefully classified and cross indexed.

Only $3.00

Over 400 pages
Over 300 Illustrations

DON'T DELAY . . . WRITE NOW

Send for your copy today. If you're not fully satisfied, return the textbook in 10 days and we'll refund the purchase price. Regular instructor discount.

FREDERICK J. DRAKE & CO.
Dept. S. S. 10—600 W. Van Buren St. Chicago, Illinois

Teach them How to Prevent "BLUE-PRINT RASH", too

Industrial statistics indicate that at least 5% of all blueprint operators are allergic to "Blueprint Rash" . . . a skin irritation caused by the customary potash developing solutions. The corrective is:

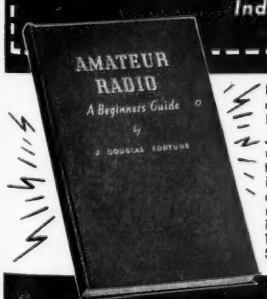
HI-TENSE CONCENTRATE

Teach your students to use this *safe* and *efficient* blueprint developing solution, the advantages of which are: No skin irritation; no spotting of prints, equipment, walls or clothing; no corrosion of plumbing or equipment. And it's economical: 1 pint of Hi-Tense at $1.35 makes 40 gallons of developing solution. Order a trial pint and make your own tests.

WISCONSIN PHARMACAL CO.
Dept. SS-10 Milwaukee 2, Wis.

YOU NEED THIS GREAT BOOK!

Indispensable for all Teachers and Students of Radio



Recognized and endorsed by radio experts, teachers, and all interested in radio, as one of the most practical, helpful, and authentic radio text books yet written.

J. Douglas Fortune's book is authoritative, readable, understandable! It covers everything from learning the code, on through receiver theory, the actual building of transmitters, modulator . . . etc. etc. right on to complete reference chapter explaining in detail most minute operations. A really indispensable book for pre-induction training! Beautifully bound in cloth—over 150 pages—post-paid for only 75c . . . or at bookstores. Special prices on quantity purchases by teachers.

THORDARSON ELECTRIC MFG. CO.
502 WEST HURON STREET • CHICAGO, ILL.

DIE-LESS DUPLICATING

DI-ACRO Precision Machines—Shears, Brakes, Benders—have made possible what practically amounts to a new production technique—"DIE-LESS DUPLICATING" for small parts and pieces. Leading schools and universities and many War Industries use DI-ACRO Machines and find them ideal for training courses. Investigate.

In illustration, left to right: 1st: DI-ACRO Shear squares and sizes material. 2nd: Brake makes angles, channels, "Vees". 3rd: Bender forms angle, channel, rod, tubing, wire, etc.

Send for catalog "Metal Duplicating Without Dies."

O'NEIL-IRWIN DI-ACRO MFG. CO.
355 Eighth Ave., So. Minneapolis 15, Minn.

from WASHINGTON by MICHAEL PACA

As predicted in these columns for September, the Vocational Rehabilitation Division of the Office of Education has been abolished.

In its place we have an Office for Vocational Rehabilitation in the Federal Security Agency, directly under Mr. McNutt's direction. Heading the OVR is a man new to education—Michael J. Shortley. Although a federal official since 1939, Mr. Shortley could not be found in Washington. He was at his desk in Baltimore, where he operates the field division of the Bureau of Old Age and Survivors Insurance for the Social Security Board.

We found Mr. Shortley busy and engrossed—but not in problems of education or rehabilitation, or anything even remotely connected with them. He was deep in his job running some 465 local field offices of the Social Security Board, trying, for example, to speed up issuing social security cards, etc.

We learned, however, that Mr. Shortley began his vocational education career back in 1919 when he joined the Federal Board for Vocational Education as a training officer. His other connection with education was as a football coach at a Catholic university.

Genial, courteous, and apparently efficient, Mr. Shortley has a reputation as "an able administrator." With Mr. John Kratz, former national head of vocational rehabilitation, as his associate director, Mr. Shortley should "learn the ropes" in quick order. Surprised Washington officials, unwarned of this action by Mr. McNutt, kept their fingers crossed awaiting reactions from the states.

As told in last month's dispatch, the new office is set up under terms of the Barden-LaFollette Act; is designed to rehabilitate civilians injured in industry, merchant marine, and civilian-defense activities; and removes the ceiling on federal amounts which the states may match dollar for dollar.

● Gremlins, closely resembling Tweedledum and Tweedledee, are plaguing Washington officials these days.

One group of little rascals whispers: "Keep children in schools. They've got to have at least a high-school education before they go to work."

Sneers the other group: "You don't mean you'll really encourage kids to stop working. Why, your production curve will drop like a plugged Messerschmitt."

And so—while many employers maintain pressure to keep young workers at their jobs, the Educational Policies Commission sends a clear-cut call for "school first." Caught between crossfires, the War Manpower Commission issues a statement in "federalese" saying, in effect: "Youth should keep on working, if practicable; youth should also continue with their schooling, if practicable."

Concerns like Lockheed, Bell Aircraft, and Goodyear Tire and Rubber have ideas of their own. They set up "four-and-four" plans or their variations, under which high-school pupils work four hours and go to school four hours; or else set up in-plant high-school programs and hire their own English and history teachers.

Meanwhile, the U. S. Office of Education plans to step up its Saturday and after-school vocational training work for high-school seniors, in effect combining general education with vocational training. But the pull from employers and paid-work is great. Will the schools succeed in retaining the bulk of their pupils?

● Another tribe of gremlins insists: "When it comes to training youth, do it quickly. Single skill, you know. One-two-three-four and over. We can't stop for that broad background stuff."

Answer: "Single skills will make mechanical robots out of youth. Is that what we're fighting for?"

The gremlins who would pull vocational courses closer to war needs of industry—which require mostly single-skill workers—seem to be having their way for the time being at least. For example: Vastly popular in Washington today is a little card—about the size of playing cards—on which is printed "the" four steps in instructing workers:

1. Prepare learner so as to put him at ease and arouse interest.

2. Present the operations and knowledge slowly, clearly, and completely, checking to see if the learner really is learning.

3. Try out the performance by having the worker do the job and correcting his errors until he really knows.

4. Follow up by checking the worker's performance and tapering off to leave him "on his own."

Using the four steps a person can "be trained"—rather taught a particular operation—in anywhere from 15 minutes to a few days, Manpower officials claim.

Rumor has it that everyone, from Mr. McNutt down, carries one of these cards in his wallet. They are considered the "aces of vocational training."

● Salvage is a word you will hear a good deal during the next months. The Army Service Forces has put into effect plans to donate to schools machinery, mechanical equipment, tools, and usable scrap for use in preinduction training courses only.

Meanwhile the Army Air Forces and Civil Aeronautics Administration are planning to donate to schools salvage planes, bombers, airplane engines, and aircraft parts for preflight training work.

(Continued on page 31)

Index to Advertisers

Allied Radio Corp. 23
Armstrong Bros. Tool Co. 11
Atlas Press Co. cover 2
Boice-Crane Co. 21
Brodhead-Garrett Co. 7
Casein Co. of America 29
Cincinnati Planer Co. 19
Cincinnati Tool Co. 25
Frederick J. Drake & Co. 31
Education Digest 25
J. A. Fay & Egan Co. 17
Fort Meigs Hotel 29
Franklin Glue Co. 25
Paul K. Guillow 17
Walter O. Gutlohn, Inc. 26
Jam Handy Organization cover 3
Higgins Ink Co., Inc. 21
International Textbook Co. 17
Jacobs Mfg. Co. 11
Lafayette Radio Corp. 7
The Macmillan Co. 21
The Manual Arts Press 27
McGraw-Hill Book Co. 23
McKnight & McKnight 26
Meissner Mfg. Co. 29
Ohmite Mfg. Co. 25
O'Neil-Irwin Mfg. Co. 31
Peerless Machine Co. 13
Plomb Tool Co. 17
Racine Tool & Machine Co. 11
E. H. Sheldon & Co. 15
Skilsaw, Inc. 2
South Bend Lathe Works cover 4
Stanley Tools 14
Thordarson Electric Mfg. Co. 31
Wisconsin Pharmacal Co. 31
X-acto Crescent Products Co. 17

Four New Kit-sets

Skills for Victory

● New slidefilm Kit-sets are now available for these courses in Pre-Induction Training:

Fundamentals of Electricity
Fundamentals of Shopwork
Fundamentals of Machines
Fundamentals of Automotive Mechanics

They are *correlated* with the Outlines of Topics for P.I.T. courses.

Teachers familiar with the Jam Handy Kit-set on Pre-flight Training will welcome this news.

In just one of these Kit-sets, Fundamentals of Electricity, there are 21 slidefilms presenting 1581 lighted pictures—ready-made drawings and diagrams available to the teacher at any moment.

Now in Use in Many Schools

Users of Jam Handy discussional slidefilms are enthusiastic in their praise of these effective visual aids—large lighted pictures that present ideas and involved concepts clearly and quickly.

Try a Kit-set in Your Classes

If you would like to try one of these Kit-sets, mail the coupon below to learn how you can have a free ten days' trial in your own classroom. Or, if you wish, you may order one or more of the complete sets at prices indicated.

D103

The Jam Handy Organization,
2900 East Grand Boulevard, Detroit 11, Michigan

☐ Please enter our order for the Kit-set(s) checked below.

☐ Fundamentals of Electricity (1581 pictures) $73.25
☐ Fundamentals of Machines (2210 pictures) 89.50
☐ Fundamentals of Shopwork (1606 pictures) 90.50
☐ Fundamentals of Automotive Mechanics (5598 pictures) 236.00

☐ Please send me without obligation full details on how I may try out a Kit-set in my own classroom.

Name .....

Position .....

Organization .....

Address .....